UNITED STATES
DEPARTMENT OF THE INTERIOR

FINAL
ENVIRONMENTAL STATEMENT

Volume 2 of 3

Proposed
1976 OUTER CONTINENTAL SHELF
OIL AND GAS GENERAL LEASE SALE
GULF OF MEXICO

OCS SALE No. 41

Prepared by the
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Note:

The regulations to which reference is made throughout this environmental statement are 30 CFR Part 250 and 43 CFR 3300, and Geological Survey OCS Orders Nos. 1 through 12 - Gulf of Mexico. The OCS Order for the Gulf of Mexico may be obtained from the Gulf of Mexico OCS office. The CFR's cited may be obtained from the United States Department of the Interior.

IV. MITIGATING MEASURES INCLUDED IN THE PROPOSED ACTION

The following discussion concerns the mitigatory measures which will reduce possible adverse impacts that could result from this proposed sale. These measures are presented as they relate to oil spills, offshore structures and pipelines as well as other impact-producing activities associated with OCS oil and gas development.

A. Oil Spills

1. Regulations

Regulations governing OCS oil and gas lease operations in the Gulf of Mexico are contained in Title 30, Code of Federal Regulations and OCS Orders Nos. 1, 3, 4, 6, 7, dated August 28, 1969, No. 2 dated January 1, 1975, No. 5, dated June 5, 1972, Nos. 8-9, dated October 20, 1970, No. 11, dated January 1, 1975, and No. 12, dated November 1, 1974. Leasing regulations are contained in Title 43, Code of Federal Regulations. The regulations established procedures and requirements to be followed in all stages of lease operations: exploration and development, drilling, production, transportation (pipeline construction and operation) and abandonment.

A general description of operating requirements under the existing regulations follows:

a. Plans: Operating plans must be submitted by the operators and approved by the Geological Survey (USGS) before each stage of operations is initiated (exploration, development and abandonment). Approval of all operations must be obtained prior to their commencement.

b. Operator inspection and testing: The operator is required to inspect all aspects of the safety systems at specific intervals, e.g., daily pollution inspection on manned facilities, "frequent" inspection on unmanned facilities, monthly test of check valves. Detailed records of inspections and tests are required.

c. Reports: The operator is required to report all spills or leakage of oil to USGS without delay. He is also required to notify the Geological Survey of any unusual condition, problem or malfunction within 24 hours. (30 CFR 250.45)

d. Safety devices: Required safety devices include subsurface safety devices, high-low pressure shut-in controls, high liquid level shut-in controls, pressure relief valves, automatic fail-close valves at the well head, automatic fire fighting systems, automatic gas detector and alarm systems, and other safety devices on production equipment; high-low pressure sensing devices and automatic shut in valves on pipelines; and blowout preventers, related well control equipment and mud system monitoring equipment on drilling wells.

e. Waste disposal: The lessee is prohibited from disposing into the ocean any oil (except that oil in produced formation water must average no more than 50 ppm, OCS Order No. 8, 2. A. 5) untreated waste material or other materials which may be harmful to aquatic life or wildlife. Any drilling mud which may contain toxic substance must be neutralized before it can be disposed of in the ocean. Drill cuttings which are predominantly sand and

shale, must be processed, and oil removed, before they can be disposed of in the ocean. [1/] Sewage samples shall be collected semi-annually by lessee personnel and the samples submitted to a laboratory for analysis. Results of the analysis will be available on the platforms and rigs for inspection by the USGS technicians. Geological Survey personnel are responsible for enforcing the requirements but do not take the samples.

f. Site clearance: When an installation is no longer needed for development of the lease, the well is plugged with cement and all casing and piling must be severed and removed to at least 15 feet below the ocean floor and the location must be dragged to clear the site of any obstruction.

g. Debris: Regulations and OCS Orders prohibit the disposal of debris into the Gulf of Mexico. Solid waste must be either incinerated or transported to shore for disposal in accordance with applicable requirements under State and Federal law.

h. Contingency plans and equipment: The operator is required to have an approved plan for controlling and removing pollution, which provides for standby pollution control equipment; including containment booms, skimming apparatus and approved chemical dispersants immediately available to the operator at a land based location; regular inspection and maintenance of such equipment.

1/ Waste disposals must comply with the 1972 Amendments of the Federal Water Pollution Control Act. Permits for disposals must be obtained from EPA under the National Pollutant Discharge Elimination System.

The Oil and Hazardous Substances Pollution Contingency Plan, Gulf Coast Region, is operative and has recently been received and updated to agree with the National Plan. In addition, the Coast Guard has established the Gulf Coast Team of the National Strike Force (NSF) at the NASA Mississippi Test Facility, Bay St. Louis, Mississippi for the purpose of responding to oil spills in the Gulf of Mexico. The National Strike Force has been established in accordance with the Federal Water Pollution Control Act and the National Oil and Hazardous Substances Contingency Plan. This team is capable of responding to incidents within two hours of notification by the appropriate District Commander.

2. Inspection

Evidence of compliance with the regulations and lease requirements is obtained through surveillance of the operations under the lease and enforcement of specific requirements. The inspection system of the Geological Survey includes: review and approval of plans before each operating stage is initiated; close review and follow-up as necessary, by USGS inspectors, of all reports required of the operator by the regulations and orders; on-site inspection and aerial monitoring through the use of helicopters (operators are also required to inform each other of oil spills or other irregularities which they observe).

a. Operator reports: A comprehensive reporting system covering all oil spills and any unusual conditions (for example: reporting and investigation of a persistent oil slick from an unknown

source such as a sunken ship or natural oil seep) is required by the orders and is a key factor in monitoring operations. Operators are also required to maintain records for periodic tests of safety equipment. Approximately 275 on-site inspections of pollution incidents reported by operators were made during 1973, 1974, and 1975.

b. On-site inspection: During the course of drilling, all operations are inspected at least one time. Leases in certain areas or in a particular development stage may require more inspections to assure the achievement of safety objectives. Geological Survey is continuing the systematic inspection program and a more stringent enforcement policy. This has resulted in increased operator compliance along with greater coverage of production operation and better documentation of inspection results.

A complete drilling inspection is normally conducted on each drilling rig approximately every four weeks. However, random inspections may be made more frequently. Depending on the number of drilling rigs in each district, the frequency of inspections on a rig may vary from eight to fourteen per year. All producing platforms are inspected at least once a year and random inspections are made more frequently on some. The frequency rate for platforms inspections is approximately one every six months.

The total number of warnings issued and suspensions ordered for infractions of OCS Orders which occurred during normal daily inspections from December 1, 1972 through June 30, 1975, are as follows:

WARNINGS			SUSPENSIONS		
Drilling	Workover	Production	Drilling	Workover	Production
71	13	4,931	42	6	3,298

During the period of October 1, 1974, through February 28, 1975, there were seven significant oil spills of more than 15 barrels reported. They are described below:

(1) A well shut-in valve in a platform control panel failed to respond to a pneumatic shutdown signal. The high liquid level control on a surge tank also failed to operate and 50 barrels overflowed through the surge tank vent line.

(2) A production platform was erroneously put on remote computer control at an onshore computer terminal. A well from which the flowline had been removed was opened to test and 120 barrels of oil were spilled.

(3) A loss of supply gas for an oil transfer pump caused a storage tank to overflow to the sump tank. Inoperative pilot failed to respond to high liquid level controls and wells continued to flow. Twenty-five barrels were spilled.

(4) A motor vessel struck a platform, tearing a hole in the fuel tank aboard the vessel, 166 barrels of diesel fuel spilled.

(5) A leak, apparently caused by corrosion, developed in an oil flow line. 40 barrels of crude oil spilled.

(6) Operator was driving a 48" caisson over a wellhead assembly which had been damaged during a hurricane. The caisson fell over, shearing casing and tubing at the mudline. The well began flowing and 200 barrels of oil were lost before the well was successfully re-entered and flow controlled. This spill was detected by personnel on the rig. Clean Gulf Associates fast response unit was dispatched and recovered most of the oil.

(7) Diesel tank aboard supply boat ruptured when boat accidently struck platform. Seventeen barrels diesel were lost and dissipated in the seas.

In accord with prescribed inspection procedures, Geological Survey personnel verified that remedial action had been taken in all of the above incidents prior to the reactivation of the production facilities.

A program of intensive inspections is used on OCS leasing. Inspections are conducted on a regular basis with emphasis placed on operations believed to require particular attention. Periodically, all available inspectors devote a week to a special inspection, where production platforms and drilling wells are inspected on a random basis. The Geological Survey inspector force in the Gulf of Mexico has increased from 7 technicians and 5 engineers as of July 1, 1969, to 43 technicians and 19 engineers as of June 30, 1975. During the period November 1, 1972 through June 30, 1975, technicians spent 11,263 inspection days or 99,036 man-hours, and engineers 1,292 inspections days or 11,415 man-hours in the field. Detailed

inspections were conducted on 3,345 major producing platforms and 2,482 minor platforms in the Gulf of Mexico from December 1, 1972 through June 30, 1975. Also, during this time period, 2,223 inspections of single-wells or satellites were made by boat: approximately 60% of these inspections were unannounced. Included in these inspections were 36,333 well completions. Also, during this time period, 3,778 inspections of drilling rigs were conducted. Date are not readily available on the significant of these date per reporting period. However, it is apparent that inspections have increased considerably per period since 1972.

The reader is referred to Sec. IV.2. for additional information on the inspections performed. Minor incidents of non-compliance result in formal warnings while incidents of non-compliance of a potentially more hazardous nature result in well or platform shut-ins until the operation is in full compliance with regulations and orders.

Tables 79-81 indicate equipment malfunctions detected during inspection and enforcement actions over three separate periods. These data include only the results of special inspections and are limited to the most frequent malfunctions detected.

These tables indicate specific items found to be in non-compliance during special inspections. Basic pollution control items or production equipment in which malfunctions were detected for the time period are

identified. Listed in the third column are the number of items which did not operate within acceptable tolerances. These items did not fail and cause an undesirable event.

Table 79 EQUIPMENT MALFUNCTION DETECTED JANUARY THROUGH NOVEMBER, 1972 SPECIAL INSPECTIONS

	No. Checked	Operable	Inoperable or not within acceptable tolerances	Percent Failure
Surface Safety Valves	1533	1480	53	3.5%
Flowline Sensors	3021	2982	39	1.3%
Check Valves	1434	1370	64	4.5%
Pressure Vessels				
High pressure sensors	961	942	19	2.0%
Low pressure sensors	610	600	10	1.6%
High level shut-in	351	345	6	1.7%
Low level shut-in	323	314	9	2.8%
Total	8,233	8,033	200	2.4%

Table 80 EQUIPMENT MALFUNCTIONS DETECTED JANUARY THROUGH NOVEMBER, 1973 SPECIAL INSPECTIONS

	No. Checked	Operable	Inoperable or not within acceptable tolerances	Percent Failure
Surface Safety Valves	1492	1423	69	4.6%
Flowline Sensors	1327	1290	37	2.8%
Check Valves	1469	1385	84	5.7%
Pressure Vessels				
High pressure sensors	1100	1077	23	2.1%
Low pressure sensors	784	771	13	1.7%
High level shut-in	405	398	7	1.7%
Low level shut-in	383	375	8	2.1%
Total	6,960	6,719	241	3.5%

Source: U. S. Geological Survey, 1975.

Table 81. EQUIPMENT MALFUNCTIONS DETECTED JANUARY THROUGH DECEMBER, 1974 SPECIAL INSPECTIONS

	No. Checked	Operable	Inoperable or not within acceptable tolerances	Percent Failure
Surface safety valves	955	915	40	4.0%
Flowline sensors	2270	2248	22	1.0%
Check valves	983	912	71	7.2%
Pressure Vessels				
High pressure sensors	207	206	1	0.5%
Low pressure sensors	176	174	2	1.1%
High level shut-in	273	265	8	2.9%
Low level shut-in	337	313	24	7.1%
Total	5,201	5,033	168	3.2%

Velocity type subsurface safety valves are periodically pulled from the wells and checked. This requires removing the valve from the well to inspect and repair or adjust as necessary and reinstall. One company utilized test stands to test the valve performance characteristics under simulated flow and pressure conditions. Surface operated subsurface safety valves are tested in place by releasing hydraulic pressure within the closed system, thus, closing the valve; and subsequently repressuring to open. An average reporting period from February through April 1975 resulted in approximately 3,000 subsurface safety valves being checked. Of this amount, there were 174 failed components detected in the valves, but a number of the valves had more than one failed component.

Nine companies were fined a total of $2,358,000 in District Court for failure to install subsurface safety devices in offshore oil wells during 1970 in the Gulf of Mexico.

c. Aerial monitoring: "Fly-overs" of the OCS operating areas are programmed on a seven day week basis by the Geological Survey. Any indications of oil pollution or other non-compliance is followed immediately by an on-site inspection.

During the period January 1, 1973 through June 30, 1975, 5,403 pollution surveillance flights were made. The helicopters chartered for use of the inspecting personnel flew a total of 16,900 hours. No data are readily available to indicate the effectiveness of this program.

3. Enforcement

The enforcement policy is intended to reduce the frequency of non-compliance with lease requirements which may lead to loss of life, property or damage to the environment; and maintain uniform enforcement standards to be applied to all operations affecting OCS lands in the Gulf of Mexico. However, more intensive inspection has been provided to operations in the frontier areas of the Gulf of Mexico, including the MAFLA and South Texas OCS areas. When, in the course of an inspection, a requirement pertaining to the prevention of oil pollution or any other safety hazard is found to be in non-compliance, the operation will be shut-in until it is brought into compliance. After shut-in, the operation can only be resumed by authorization of the Geological Survey; in all cases, this requires reinspection or a waiver of the inspection requirement. Minor incidents of non-compliance may require only a warning that corrections be made within a week. The operations will be shut-in if the required corrections are

not made.

Additional penalties for non-compliance are specific in P. L. 83-212, Outer Continental Shelf Lands Act, Sec. 5(a)(2).

> "Any person who knowingly and willfully violates any rule or regulation prescribed by the Secretary for the prevention of waste, the conservation of the natural resources, or the protection of correlative rights shall be deemed guilty of a misdemeanor and punishable by a fine of not more than $2,000 or by imprisonment, and each day of violation shall be deemed to be a separate offense."

Also Sec. 5(b)(1) and (2) provide for cancellation of non-producing and producing leases by notice subject to judicial review or appropriate judicial proceedings.

Experienced personnel, private and government, are aware that after public attention was focused on the oil spill at Santa Barbara in January, 1969, there has been a great deal less oil pollution in the Gulf from normal oil and gas producing operations. Table 81.1 summarizes the oil spills in the Gulf since 1972.

In the past, major events were catalogued, but less serious events were often not reported. Occasionally, some years ago, wells were even intentionally flowed into the water for short periods during clean-up operations. Now, sophisticated burning devices are designed to consume this well clean-up oil without air or water pollution. More automatic equipment is now in use to shut in production whenever a leak occurs in pipeline or production facilities. These include but are not limited to pressure sensors and high and low level controls. Drip pans are placed under valves, vessels and the production system to prevent leaking oil from escaping into the waters of the Gulf.

During the past four years the average number of pipeline malfunctions which resulted in oil spillage was approximately twenty per year; thirty occurred during 1974. This apparent increase may be attributed to: increased inspections and better reporting; increased footage of pipelines; age of existing pipelines; and damage by tropical storms (personal communication, USGS, 1975)

Table 81.1 SUMMARY OF OIL SLICKS AND OIL SPILLS

Information related to oil spills which occurred from October 1, 1974, through June 30, 1975, is summarized below.

MONTH	NO.SPILLS	VOL.CRUDE (BARRELS)	VOL.OTHER	NO.OF SPILLS ONE BARREL OR LESS	NO. SLICKS SIGHTED
Oct.	8	82	-	103	31
Nov.	8	150	-	74	31
Dec.	6	238	-	58	32
Jan.	8	46	-	68	26
Feb.	9	33	17 Diesel	80	55
Mar.	11	24	6 Condensate 169 Diesel	83	30
Apr.	7	58	-	99	39
May	12	27	-	82	72
Jun.	7	31	-	96	40
Subtotal	76	689	6 Condensate 186 Diesel	743	356
TOTAL SINCE NOVEMBER 1972	381	45,505	62 Condensate 507 Diesel 44 Oil Base Mud 3 Distillate 10 Corrosion Inhibitor	1126	531

Sources = Geological Survey, Metairie, Louisiana (July 29, 1975)

From January 1, 1971, through April 30, 1975, there were approximately 33,471 barrels of oil produced per barrel of oil spilled.

4. Contingency Action

Oil spills will occasionally occur as a result of natural disasters, equipment failure or human error. In the event that such an emergency occurs, the following action will be taken:

a. Requirements of OCS Order No. 7

In the case of any spill, the operator is required to initiate action to control and remove the oil pollution in accordance with his approved emergency plan. In any case, a spill or leakage of less than 15 bbls. requires a report from the operator as to the nature of the spill or leakage, why it occurred and what steps were taken to correct it. A spill of 15-50 bbls. must be reported by telephone immediately to USGS and confirmed in writing. A spill of over 50 bbls. or one of any magnitude that cannot be immediately controlled, must be reported immediately to the Coast Guard, the Environmental Protection Agency and the Geological Survey.

b. Regional or National Contingency Plans

If the operator should be unable to control and remove the pollution, the Regional or National Oil and Hazardous Substances Pollution Contingency Plan may be activated and the designated Federal On-Scene Coordinator would direct control and

clean-up operations at the operator's expense. This has never been necessary in the case of any spill from OCS operations to date.

The Regional or National Oil and Hazardous Substances Pollution Contingency Plan was developed pursuant to the provisions of the Federal Water Pollution Control Act as amended (33 U.S.C. 1101). (EPA has published the revised National Oil and Hazardous Substance Pollution Contingency Plan as required by the Federal Water Pollution Control Act Amendments of 1972). Section 11(c)(2) of that statute authorized the President, within sixty days after the sections become effective, to prepare and publish such a Plan. The Plan provides for efficient, coordinated and effective action to minimize damage from oil (and other) discharges, including containment, dispersal and removal. The Plan includes: assignment of duties and responsibilities; identification, procurement, maintenance and storage of equipment and supplies; establishment of a strike force and emergency task force; a system of surveillance and notice; establishment of a national center to coordinate response operations; procedures and techniques to be employed in identifying, containing, dispersing and removing oil; and a schedule identifying dispersants and other chemicals that may be used in carrying out the Plan, the waters in which they may be used and quantities which may be safely used. 1/ The Plan is revised from time to time as necessary. Operation of the National Contingency

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1/ Annex X of the Plan basically sets forth a no dispersant policy. Exceptions can be made for safety reasons (to prevent fire or explosions) or for certain other circumstances such as the protection of endangered waterfowl. However, the approval of EPA is required, except in case of safety when the approval of the On-Scene Coordinator is required.

Plan requires a nationwide net of regional contingency plans. Guidelines for that nationwide net are established in the National Plan. This plan provides for a pattern of coordinated and integrated responses to pollution spills of departments and agencies of the Federal Government. It establishes a national response team and provides guidelines for the establishment of regional contingency plans and response teams. The Plan also promotes the coordination and direction of federal, state and local response systems and encourages the development of local government and private capabilities to handle such pollution spills.

The objectives of the Plan are: to develop appropriate preventive and preparedness measures effective systems for discovering and reporting the existence of a pollution spill; to institute promptly, measures to restrict further spread of the pollutant; to assure that the public health, welfare, and natural resources are provided adequate protection; to provide for the application of techniques to clean-up and dispose of the collected pollutants; to provide for a scientific response to spills as appropriate; to provide strike forces of trained personnel and adequate equipment to polluting spills; to institute actions to recover clean-up cost; and, to effect enforcement of existing federal statutes and regulations issued thereunder. Detailed guidance toward the accomplishment of these objectives is contained in the basic Plan, the annexed and the regional plans.

The Plan is effective for all United States navigable waters including inland rivers, Great Lakes, coastal territorial waters and the contiguous zone and high seas beyond this zone where a threat exists to United States waters, shore-face or shelf-bottom. Its provisions are applicable to all federal agencies.

A memorandum of understanding between the Department of the Interior and Transportation outlines the respective responsibilities of the Geological Survey and the Coast Guard under the National Contingency Plan. The Geological Survey is responsible for the coordination and direction of measures to abate the source of pollution when the source is an oil, gas or sulphur well. This responsibility includes the authority to determine whether pollution control operations within a 500 meter radius of the pollution source should be suspended to facilitate measures to abate the source of pollution. The Coast Guard is responsible for coordinating and direction of measure to contain and remove pollutants, and shall furnish or provide for the On-Scene Coordinator with authority and responsibilities as provided by the National Contingency Plan.

c. Petroleum Industry Contingency Plan

(1) Inventory of known resources available for emergency oil spill control and clean-up

From the upper Texas coast to the Mississippi Delta region offshore operators maintain a large inventory of various kinds of equipment that could be put to use on short notice for containing and cleaning up an oil spill and killing the source of the spill. This inventory includes 177 boats ranging from 30

crewboats to 165 foot utility and cargo vessels, 64 helicopters, 103 fixed-wing aircraft. For a complete inventory of oil spill containment and clean-up equipment see Appendix C.

(2) Clean Gulf Associates

Clean Gulf Associates is a non-profit organization formed by thirty-nine companies (these companies produce 98% of offshore petroleum) operating in the OCS. Their purpose is to provide for a stock pile of oil spill containment and clean-up materials for use by member companies in offshore and estuarine areas. Clean Gulf Associates has contracted, effective August 1, 1972, with Halliburton Services to supply equipment, materials and personnel necessary to contain and clean-up spills in the Gulf of Mexico to the limits of the OCS lying offshore and seaward of the states of Texas, Louisiana, Mississippi, Alabama and Florida.

All of the tracts considered in this proposed lease sale fall within this area. Before any drilling commences, should this proposed sale be held, an inventory of pollution combatting equipment would be stockpiled at a strategic location. Should oil reservoirs be found and production ensue, a permanent base of containment and clean-up equipment will be established.

At the present time, Halliburton maintains four types of recovery/clean-up systems for development at four primary bases located at Intercoastal City and Grand Isle, Louisiana; Panama City and Bradenton, Florida, and a sub-base at Venice, Louisiana, and

include: fast response open sea/bay, high volume open sea, and shallow water skimmer systems and auxiliary shallow water and beach clean-up equipment.

d. Effectiveness of Clean-up Operations

The effectiveness of offshore cleanup is weather contingent. The equipment which is now stockpiled and available as well as that which will be built in the near future, is not completely effective in high winds or waves. The average recovery of oil spilled at sea is on the order of 20 percent (Biglane, 1975).

A major problem of spill clean-up operations involves the disposal of oil contaminated debris. If a spill involves a large quantity of such debris, an acceptable disposal site must be found. The residents of shore communities are becoming increasingly reluctant to commit their disposal sites, which are of limited capacity, to this use. If the debris is not disposed of properly, secondary contamination of surface or ground waters can result.

For a complete inventory of oil spill containment and clean-up equipment see Appendix C.

B. Structures

If a ship strays from established safety fairways, oil and gas platforms can pose a hazard to commercial shipping. This hazard, however, is minimized by the fact that safety fairways are clearly designated on navigation charts. Directional drilling from outside safety lanes is used to develop tracts lying partially in safety lanes. Pertinent portions of the Federal Regulations (33 CFR Sec. 209.135 (b), 1971), governing shipping fairways and anchorage areas are as follows:

> "The Department of the Army will grant no permits for the erection of structures in the area designated as fairways, since structures located there in would constitute obstructions to navigation. The Department of the Army will grant permits for the erection of structures within an area designated as an anchorage area, but the number of structures will be limited by spacing as follows: The center of a structure to be erected shall be not less than two (2) nautical miles from the center of any existing structures. In a drilling or production complex, associated structures shall be as close together as practicable having the consideration for the safety factors involved. A complex of associated structures, when connected by walkways, shall be considered one structure for the purposes of spacing. A vessel fixed in place by moorings and used in conjunction with the associated structures of a drilling or production complex, shall be considered an attendant vessel and its extent shall include its moorings. When a drilling or production complex includes an attendant vessel and the complex extends more than five hundred (500) yards from the center of the complex, a structure to be erected shall no be closer than two (2) nautical miles from the near outer limit of the complex. An underwater completion installation in an anchorage area shall be considered a structure and shall be marked with a lighted buoy as approved by the United States Coast Guard."

Development of the tracts in this proposed sale which lie partially within shipping fairways or anchorage areas if leased will be subject to Federal regulations as presented above so far as placement of structures is concerned and this would help mitigate any potential impact due to the proximity of structures to relatively high frequency sea traffic.

Commercial vessels are required to report to the Coast Guard whenever a casualty results in any of the following: actual physical damage to property in excess of $1500, material damage effecting the sea-worthiness or efficiency of a vessel, stranding or grounding, loss of life or injury causing any person to remain incapacitated for a period in excess of 72 hours; except injury to harbor workers not resulting in death and not resulting from vessel causalty or vessel equipment casualty. Drilling and production platforms (artificial islands) are required to report to the Coast Guard when involved in a casualty or accident and if any of the following occur: if hit by a vessel and damage to property exceeds $1500, damage to fixed structure exceeds $25,000, material damage affecting usefulness of lifesaving or firefighting equipment or loss of life.

Under some condition, offshore structures are an obstacle to commercial fishing activities. Depending on currents and underwater obstacles an offshore structure can remove areas of trawling and purse seining waters. Heavy concentrations of platforms can make trawling and purse seining difficult.

The erection of more structures on the OCS may affect commercial fishing operations. The impact from platforms may be kept to a minimum, however, by only allowing those structures necessary for proper development and production of the mineral resources, and by placing them with due regard to fishing operations and other competing uses which are evident at the time of platform approval.

The Area Oil and Gas Supervisor considers the views of commercial fishing organizations such as the Gulf State Marine Fisheries Committee with regard to placement of platforms. The Supervisor also from time to time requests information from the Department of Commerce, National Oceanic and Atmospheric Administration and National Marine Fisheries Service to be used in his decision making process of approving or disapproving platform installation. Within the constraints of location of the reservoirs and the technology necessary to drill directional wells, the Supervisor is mindful that platform location is an important consideration for commercial fisheries and does make decisions to minimize the impact for platform location on the commercial fishing industry.

In an effort to further mitigate the impact of offshore structures resulting from this proposed sale with regard to commercial fishing and other significant existing or future uses of the leased area, a lease stipulation giving effect to the following will be applied to all blocks in this proposed offering in the event they should lease:

"Structures for drilling or production, including pipelines, shall be kept to the minimum necessary for proper exploration, development and production and to the greatest extent consistent therewith, shall be placed so as not to interfere with other significant uses of the Outer Continental Shelf including commercial fishing. To this end, no structure for drilling or production, including pipelines, may be placed on the Outer Continental shelf until the Supervisor has found that the structure is necessary for the proper exploration, development, and production of the leased area and that no reasonable alternative placement would cause less interference with other significant uses of the Outer Continental Shelf including commercial fishing. The lessee's exploratory and development plans, filed under 30 CFR 250.34, shall identify the anticipated placement and grouping of necessary structures, including pipelines, showing how such placement and grouping will have the minimum practicable effect on other significant uses of the Outer Continental Shelf, including commercial fishing."

C. Pipelines

1. Existing Responsibilities

Federal responsibility and authority for gas and oil pipeline routing or operation on submerged coastal lands is vested in a number of agencies, including the following: Department of the Interior, (a) Bureau of Land Management-- rights-of-way for common carrier pipelines on the OCS, (b) Geological Survey--jurisdiction over producer owned gathering lines and flow-lines on the OCS and (c) U.S. Fish and Wildlife Service--protection of fish and wildlife resources and their habitat through consultation with the Corps of Engineers in the process of issuing Federal permits in navigable waters; U.S. Army Corps of Engineers--issues permits for construction (including pipelines) on OCS and in other navigable

waters; Federal Power Commission--grants certificates of convenience and necessity prior to construction of interstate natural gas pipelines; Interstate Commerce Commission--grants approval of the tariff rates for transportation of oil by common-carrier pipelines; Department of Transportation, Office of Pipeline Safety--establishes standards for pipeline construction, operation and maintenance; and Department of Commerce, National Oceanic and Atmospheric Administration, National Marine Fisheries Service--protection of marine fishery resources and their habitat (in coordination with the U.S. Fish and Wildlife Service), through consultation with the Corps of Engineers in the process of issuing Federal permits in navigable waters.

At present, the cooperative effort between the Department of the Interior and the Corps of Engineers, and the National Marine Fisheries Service and State conservation agencies is responsible for minimizing the impact of pipeline (and other) construction in navigable waters of the United States. The Corps of Engineers, through authority of the Rivers and Harbors Act of 1899, (33 U.S.C. 403) asserts authority over, and requires a permit for construction in all navigable waters subject to the Submerged Lands Act (43 U.S.C.S1301) and includes all lands permanently or periodically covered by tidal waters up to the line of mean high tide.

The Environmental Protection Agency reviews and comments on dredging projects in navigable waters in accordance with a memorandum of understanding with the Corps of Engineers dated July 13, 1967.

The National Oceanic and Atmospheric Administration (through its National Marine Fisheries Service) has been vested with responsibility for participation in matters relating to marine and estuarine areas.

The Department of the Interior and its U.S. Fish and Wildlife Service has responsibility and authority under several statutes, including the Fish and Wildlife Act of 1956, the Estuary Protection Act, the Endangered Species Act of 1973, the Migatory Bird Conservation Act, the Fish and Wildlife Conservation Act, the Marine Mammals Protection Act, and various international treaties enacted to preserve, conserve, protect and enhance fish and wildlife resources and their habitat.

The U.S. Fish and Wildlife Service, with assistance from appropriate State and Federal agencies, including the National Marine Fisheries Service now reviews all applications to the Corps of Engineers for permits to construct pipelines in navigable waters and assess their potential impact on fish and wildlife resources and the environment. When appropriate, the Agency recommends to the Corps specific modification of project plans which are needed to reduce impact on these resources. Occasionally a project plan is so conceived that significant impact cannot be avoided, but at the same time, a satisfactory alternative may not be available; in such cases, a recommendation that the permit not be issued would be appropriate.

2. Mitigating Measures

Federal, State or local authorities or private landowners, may take measures to require, depending upon circumstances and location, that pipelines be buried; that canals in wetland areas be backfilled where possible, that bulkheads be erected and maintained in marsh areas to prevent saltwater intrusion; that specific types of dredging equipment be used and specific methods for placement or disposal of spoil be required; that beach and dune areas crossed by pipeline be restored; that pipeline installations in sensitive or valuable areas be seasonally timed so as to occur, for example, during low periods of tourist and recreational activities, or prohibited during low periods of tourist and recreational activities, or prohibited during acute periods of nesting of waterfowl or migrations of fish and wildlife.

The Department will ultimately receive applications for the OCS component of pipelines resulting from this sale, and after considering all factors, may approve pipeline rights-of-way. The procedure for this is outlined in a recent Memorandum of Understanding between the Bureau of Land Management and the Geological Survey for Outer Continental Shelf Pipelines. The purposes of the Memorandum is to clearly define the administrative and operational roles of the Bureau of Land Management and the U.S. Geological Survey relating to pipelines on the OCS, to provide consistent and standardized procedures, and to minimize or eliminate dual and overlapping functions. The objectives of the Memorandum are to:

(a) Provide an efficient mechanism for approving pipeline routes through the submerged lands of the OCS.

(b) Initiate measures to provide safety and to minimize or eliminate environmental damage which may be associated with the installation and operation of pipelines originating on the OCS.

(c) Be responsive to the interests of the oil and gas industry, other users of the OCS, and the public with respect to pipelines.

(d) Streamline implementation of the regulations and procedures for more efficient and uniform administration of the Department's authority with respect to pipelines.

The Bureau of Land Management's role in pipeline management on the OCS is defined as follows:

(a) Conduct pipeline routing studies and, with the concurrence of the USGS, designate pipeline corridors on the OCS for all pipelines other than flow or gathering lines within the confines of a single lease or group of contiguous leases under unitized operation or a single operator.

(b) Maintain a central office of record for the location of all existing and future pipelines as specified in paragraph I.A. and associated structures on the OCS.

(c) Prepare environmental assessments, pipeline system planning studies, economic studies, and environmental impact statements when necessary or appropriate, prior to approving applications for rights-of-way pursuant to 43 U.S.C. 1-34(c) and 43 CFR 2883.

(d) Receive applications for rights-of-way for pipelines to be installed on the OCS pursuant to 43 U.S.C. 1334(c) and 43 CFR 2883.

(e) After considering the potential impact of the pipelines on the environment, the relationship of the application to existing pipeline routes on the OCS, and other factors, approve or disapprove the application pursuant to 43 CFR 2883.

This memorandum notwithstanding, some potential adverse effects related to OCS induced pipeline sitings occur nearshore and onshore and generally remain outside BLM authority to apply direct mitigatory measures. However, the ability to regulate pipelines on the OCS implies certain influence over the allocation of nearshore and onshore response. This ability represents a management tool with the potential to indirectly mitigate many adverse effects of random pipeline placement in areas beyond BLM authority. The ability to structure one component of a total transportation system permits a greater degree of departmental management, control and environmental responsiveness if federal, industry and state expressions of pipeline requirements and siting policy - offshore and onshore are integrated during pre-planning stages.

The Department plans to optimally structure sale-related pipeline development and locational schemes for tracts leased in this proposed sale as per our responsibility for pipeline system planning on the OCS. Optimum pipeline development is partly a function of environmental capabilities (both offshore and onshore), operational and economic dictates and the transportation needs of the impacted area. Recognition of these parameters in a coordinated federal, state and industry effort will result in pipeline sitings which recognize zones of least environmental impact and economic feasibility, according to articulated studies, plans, policies and controls. Such an effort is anticipated before the granting of pipeline rights-of-way induced by this sale.

D. Special Studies

Several scientific investigations are being conducted in the Gulf of Mexico to obtain data that may be used in future evaluations of offshore leasing (Table 82). However, only two will serve as a mitigatory measure. These are discussed below.

An investigation effort has been contracted to conduct a submersible reconnaissance of 14 to 18 topographic highs on the Texas OCS. The reconnaissance would allow visual (operators' reports, videotape and still photographs) characterization of these sites as potentially valuable resources (commercial fish havens, reefs or reef-type communities). Biological and geological sampling will also be conducted.

The sites that will be surveyed are presented below:

(1) 29 Fathom Bank*
93° 29.25', 28° 08.5'

(2) 28 Fathom Bank*
93° 26.4, 27° 55.0'

(3) Little Sister
94° 14.5', 27° 52.0'

(4) 32 Fathom Bank
94° 32.0', 28° 03.7'

(5) Baker*
96° 13.5', 27° 45.0'

(6) South Baker*
96° 16.4', 27° 40.25'

(7) Aransas*
96° 27.0', 27° 35.3'

(8) Hospital*
96° 29.0'. 27° 33.2'

(9) Southern*
96° 31.05', 27° 26.05'

(10) Dream*
96° 42.5', 27° 02.5'

(11) Big Adam*
96* 48.5', 26° 57.5'

(12) Blackfish*
96° 46.5', 26° 52.7'

(13) Little Adam Rock*
96° 49.0', 26° 47.5'

(14) Mysterious*
96° 42.5', 26° 46.'

(15) Small Adam*
96° 51.0, 26° 56.5'

(16) Four Rocks
94° 00.5', 28° 27.5'

(17) East Banks*
96° 50', 26° 03'

* Mapping has been completed.

Table 82 Status of BLM Environmental Studies

Outer Continental Shelf

TITLE	CONTRACTOR	DUE DATE	STATUS
MAFLA Environmental Baseline Study	SUSIO R. Smith, P.C. 1/	March 30, 1975	Final Report Accepted
South Texas Environmental Baseline Study	USGS H. Berryhill, P.C.	April 1, 1976	Second Sampling Season Completed
Hydrocarbon Quality Control Analyses	UNO J. Laseter, P.I. 2/	Circa June, 1976	Contract Extended
Trace Metal Quality Control Analyses	GSRI J. Montalvo, P.I.	April 1, 1975	Contract Extended
Eastern Gulf of Mexico Hydrography	SUSIO M. Rinkel, P.C.	May 1, 1975	Draft Final Report Submitted
A Biological and Geological Reconnaissance of Selected Topographic Features on the Texas Continental Shelf	Texas A & M T. Bright, P.I.	Dec., 1975	Field Work Completed
Gulf of Mexico OCS Cultural Resource Sensitivity Zone Mapping Project	Coastal Environments, Inc. S. Gagliano, P.I.	Aug. 15, 1975	Preliminary Report in preparation

1/ Project Coordinator

2/ Principal Investigator

The onshore coastal zone is diverse and varied in its environmental values and tolerances to pipeline construction. Some of it, because of cultural or natural values may be highly suitable for such activity, while other areas may exhibit severe constraints. The control of potential onshore impacts from overland pipeline construction remains in the hands of state and local authorities or landowners, since federal authority over pipeline placement is limited in a shoreward direction to navigable waters and adjacent wetlands. The coastal zone management program presently under development in the five gulf states will provide them with a further mechanism for controlling such potential impacts. Should sufficient production results from the OCS to warrant new pipeline landfalls, BLM will participate with the states in identifying the areas most intrinsically suitable for pipelines and related developments onshore.

On December 21, 1974, the Assistant Secretary of the Interior requested the National Petroleum Council to undertake a study concerned with the availability of materials, manpower and equipment necessary for the exploration and production of oil during the subsequent two years.

The results of this study were published during September, 1974, by the National Petroleum Council under the title "Availability of Materials, Manpower and Equipment for the Exploration, Drilling and Production of Oil -- 1974-1976"

BLM field offices review, on a periodic basis, information available in their areas concerning several factors, including the availability of materials, manpower and equipment for the conduct of exploration and production activities.

D. Other Mitigating Measures

1. Special Stipulations

Leases for oil and gas exploration and development are subject to all OCS operating regulations and orders. Additionally, in some cases, the lease may include special stipulations which are considered necessary for the protection of a particular resource or activity.

Section 2(b) of Executive Order 11593 requires that, until inventories and evaluations can be completed, caution should be exercised over federally owned property to avoid damage or alteration of cultural resources potentially suitable for inclusion on the National Register of Historic Places. A Department of the Interior study is under contract to identify areas of the Gulf of Mexico which contain, or have a high potential for containing, significant historical or archaeological resources.

It is proposed that the following stipulations be applied to any lease resulting from this proposed sale for the protection of historical, archaeological or architectural values:

a. If the Supervisor, having reason to believe that a site, structure, or object of historical or archaeological significance, hereinafter referred to as "cultural resource" may exist in the lease area, shall, within one year from the effective date of this lease, give the lessee written notice that the lessor is invoking the provisions of this stipulation, the lessee shall immediately upon receipt of such notice comply with the following requirements:

Prior to any drilling activity or the construction or placement of any structure for exploration or development on the lease, including, but not limited to, well drilling and pipeline and platform placement, hereinafter referred to as "operation", the lessee shall conduct geophysical surveys to determine the potential existence of any cultural resource that may be affected by such operation. All data produced by such geophysical surveys shall be examined by a qualified marine archaeologist or archaeological surveyor to determine if anomalies are present which suggest the existence of a cultural resource that may be adversely affected by any lease operation. If such anomalies exist the lessee shall: (1) locate the site of such operation so as not to adversely affect the anomaly identified; or (2) establish, to the satisfaction of the Supervisor, on the basis of further archaeological investigation conducted by a qualified marine archaeologist using such survey equipment and techniques as deemed necessary by the Supervisor, either that such operation will not adversely affect the anomaly identified or that the potential cultural resource suggested by the occurrence of the anomaly does not exist.

Upon completion of any geophysical or other survey conducted for archaeological purposes the lessee shall forward a report prepared by the archaeologist or archaeological surveyor to the Supervisor for his review. Should the Supervisor determine that the existence of a cultural resource which may be adversely affected by such operation is sufficiently established to warrant protection, the lessee shall take no action that may result in an adverse effect on such cultural resource until the Supervisor has given directions as to its disposition.

The lessee agrees that, if any site, structure, or object of historical or archaeological significance should be discovered during the conduct of any operations on the leased area, he shall report immediately such findings to the Supervisor, and make every reasonable effort to preserve and protect the cultural resource from damage until the Supervisor has given directions as to its disposition.

Archaeology reports covering leases issued as a result of this proposed sale will be submitted to the Supervisor of the Geological Survey and to the Manager of BLM. The equipment and procedures to be used in conducting archaeological surveys and the format of the reports has been agreed to by BLM, U.S.G.S., and the National Park Service, and published by the Geological Survey Supervisor as Notice to Lessees and Operators 75-3.

The Manager will review these reports and provide the Supervisor with recommendations for protection of any known or potential cultural resources identified therein. The Supervisor will consider these recommendations and any other relevant information at his disposal prior to issuing a permit for operations at a specific location within a lease.

b. To avoid conflict with present uses of the Flower Garden Banks as a unique study area and potential future as a marine sanctuary, a stipulation will be applied to tracts 25, 26, and 29 in the event they should be leased, the effect of which will be as follows:

> No structures, drilling rigs, or pipelines will be allowed within the aliquots established for the East and West Flower Garden Banks (see figs, 30 and 31 Sec. III.A.4). Exploration and development operations are permitted within the circle, outside above aliquots, with radius of 20,064 feet around point P; located by X = 3,742,875, Y = 71,280 for East Flower Garden and X = 3,674,965, Y = 50,690 for West Flower Garden (Texas Lambert System).
>
> Operations in this zone are restricted as follows; Drill cuttings and drilling muds must be disposed of by shunting the material to the bottom through a downpipe that terminates an appropriate distance from the bottom as determined by the Supervisor; however, if the shunting method is not adequate to protect the unique character of the subject

area, then the Supervisor will require barging the material a minimum of ten miles from any 25 fathom isobath surrounding live reef-building corals before disposal. Sould barging be the method selected, disposal sites must be approved by the Supervisor.

No garbage, untreated sewage, or other solid waste shall be disposed from vessels (work-boats, crew-boats, supply boats, pipe-laying vessels) during exploration and development operations within the area of the bank described above for exploration and development operations.

No drilling permits will be issued by the Supervisor until he has found that the lessee's exploration and development plan filed under 30 CFR 250.34 is adequate to insure that exploration and production operations in the leased area will have no significant adverse effect on the biotic community of high value reef sites on the Flower Garden Banks. As a part of the development plan, a reef monitoring program must be included.

The monitoring program will be designed to assess the effects of oil and gas exploration and development operations on the viability of the coral reefs. The development plan should indicate that the monitoring program will be conducted by qualified independent scientific personnel and that program personnel and equipment will be available at the time of operations. The monitoring team will submit its findings to the Supervisor on an interim on-going basis, or immediately in case of imminent danger to the reefs resulting directly from drilling or other operations.

c. For protection of offshore fishing banks it is proposed that the following stipulation be applied to leases resulting from this sales on tracts 7, 30, 35, 37, 47, 53, 56, 63, 71, 72, 77, 78 79, 80, 88, 92, 95, 96, 102, 104, 105, 106, 107, 113, 114, and 115.

The lessee agrees that, prior to any drilling activity or placement of any permanent production structures, he will submit as part of his exploration and/or development plan, geophysical or other data on seafloor features sufficient to prove to the Supervisor's satisfaction that conflict with any fishing activities in these areas will be kept to a minimum. Included in the exploration and/or development plan will be the bottom mapping of the proposed drilling sites. On the basis of proximity to topographic features,

as determined from the data, these sites should be so located as to cause minimal conflict with any fishing activities in these areas. The aforementioned exploration and/or development plan must be submitted to the Supervisor for approval.

Drill cuttings and drilling muds must be disposed of by shunting the materials to the bottom through a downpipe that terminates an appropriate distance from the bottom or by other appropriate methods if determined by the Supervisor to be necessary to protect the unique character of the subject area.

No drilling permits will be issued by the Supervisor until he has found that the lessee's exploration and/or development plan filed under 30 CFR 250.34 is adequate to insure that exploration and production operations in the lease area will have a minimal adverse effect upon any fishing activities on these tracts.

d. Agreement to the incorporation of the following stipulation into leases awarded as a result of Sale 41 was obtained by telephone on November 5, 1975 from Jim Barkuloo, U.S. Fish and Wildlife Service, Panama City, Florida and Joe Higham, U.S. Fish and Wildlife Service, Galveston, Texas. The wording of the stipulation was agreed to by telephone between the Geological Survey Gulf of Mexico office and the BLM New Orleans OCS office on November 5, 1975.

"If a pipeline is technically and economically feasible, no oil production will be transported by barge from this offshore lease to onshore facilities in the States of Florida, Mississippi and Alabama except in case of emergency or unusual circumstances. Determination as to emergency or other conditions and the technical and economic feasibility of pipeline installation will be made by the Area Oil and Gas Supervisor. For continuous production, transportation of oil by barge from this lease to onshore facilities in the States of Florida, Mississippi, and Alabama will not be permitted."

The stipulation will be incorporated into leases awarded on the following tracts: 73, 76 through 135.

e. To apply to all leases resulting from these lease sales.

(1) Structures for drilling or production, including pipelines, shall be kept to the minimum necessary for proper exploration, development, and production, and to the greatest extent consistent therewith, shall be placed so as not to interfere with other significant uses of the Outer Continental Shelf including commercial fishing. To this end, no structure for drilling or production, including pipelines, may be placed on the Outer Continental Shelf until the Supervisor has found that the structure is necessary for the proper exploration, development and production of the lease area and that no reasonable alternative placement would cause less interference with other significant uses of the Outer Continental Shelf, including commercial fishing. The lessee's exploratory and development plans, filed under 30 CFR 250.34, shall identify the anticipated placement and grouping of necessary structures, including pipelines, showing how such placement and grouping will have the minimum practicable effect on other significant uses of the Outer Continental Shelf, including commercial fishing.

(2) The lessee shall have the pollution containment and removal equipment available as required by OCS Order No. 7, of August 28, 1969, as may be amended. After notification by the Operator to the Supervisor of a significant oil spill as defined by OCS Order No. 7, or an oil spill of any size or quantity which cannot be immediately controlled, the operator shall immediately deploy the appropriate equipment to the site of the oil spill, unless, because of weather and attendant safety of personnel the Supervisor shall modify this requirement.

2. Notices to Lessees and Operators

These notices have the same effect or status as OCS Operating Orders and Regulations and are used when expeditious clarifications or corrections and additions to existing orders and regulations are necessary. By issuing Notices to Lessees and Operators, the extensive amount of time necessary to amend and republish orders and regulations is avoided. One example of a Notice, issued 12 August 1974 explains and details minimum biological survey requirements for the Florida Middle Ground area.

3. Departures

A departure (waiver) from OCS orders or other rules of the GS Supervisor may be granted when such a departure is determined to be necessary for (30 CFR, 250.12(b)): the proper control of a well, conservation of natural resources, protection of aquatic life, protection of human health and safety, protection of property or protection of the environment.

Waivers are technically based decisions and are granted in situations only where expert judgment determines that better and safer operations would result from operations under the waiver.

4. Research on Advanced Technology

EPA and Coast Guard are conducting research on more efficient containment and recovery devices (booms and skimmers). The efficiency of booms and skimmers depends on sea state and spill conditions but in any case are never 100% efficient.

When the results of these studies, and any other similar studies so indicate, the requirement for use of better techniques and equipment will be incorporated into the OCS regulations and orders as appropriate. If incorporated, the requirements will be applied to all leases.

5. Geophysical Information

The Conservation Division of the Geological Survey (GS) is aware of the near-surface structural configuration and its effects on drilling, fixed-structural emplacement, pipelines, etc., relative to the proposed lease tracts. Knowledge of near-surface structural conditions is fundamental to a sound lease management program for the OCS.

Geophysical data, which show the shallow structural and sedimentary environment, are used to predict, and thus minimize, any geologic hazards to drilling operations and consequent possible dangers to the environment from pollution. Surface and shallow subsurface geologic hazards, when properly identified and correlated with surrounding strata, seldom create insurmountable obstacles to a minimal risk program of exploration and exploitation of economically attractive structures.

High-resolution geophysical data covering all tracts to be offered for sale will be purchased by GS and analyzed by GS geophysical personnel. These data, in the area of coverage, provide definitive information on thickness of the unconsolidated sediment; structural

configurations on shallow seismic horizons; sea floor anomalies, mud mounds, mud waves or potential slide areas, pipeline and other objects on the sea floor, and suitable locations for bore holes as interpreted from a combined analysis of several geophysical measurements and bathymetry.

Information from these high resolution data are extremely useful in detecting shallow geologic hazards such as potentially unstable bottom conditions (mud waves, etc.), shallow faults, and in some cases, near-surface gas pockets. When these features are identified prior to drilling operations or platform construction, the operator is notified so that he can take the necessary action to assure that his operation is conducted with maximum safety.

Interpretations of high resolution subbottom profile data, that will disclose bottom and subsurface conditions posing special environmental hazards for drilling or producing operations in the Texas offshore area, will be made available to the Bureau of Land Management prior to the decision to issue a lease, and to the Geological Survey prior to the approval of drilling operations. 1/

A departure (waiver) from OCS orders or other rules of the GS Supervisor may be granted when such a departure is determined to

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1/ The District Engineer, Geological Survey, will prohibit the placement of platforms on areas of instability, should the need arise, through his authority to issue or not issue permits for platform placement.

be necessary for (30 CFR, 250.12(b)): the proper control of a well; conservation of natural resources; protection of aquatic life; protection of human health and safety; protection of property or protection of the environment.

6. Conservation Practices

The Oil and Gas Supervisor, in the interest of conservation, is authorized pursuant to the Code of Federal Regulations, to approve well locations and well spacing programs necessary for proper development, giving consideration to such factors as the location of drilling platforms, the geological and reservoir characteristics of the field, the number of wells that can be drilled economically, the protection of correlative rights and the minimizing of unreasonable interference with other uses of the outer continental shelf. The Supervisor draws his authority from the following regulations and OCS operation orders:

30 CFR 250.11 outlines in broad terms the Supervisor's authority to control development of the OCS to protect the environment, and to obtain maximum economic recovery of mineral resources under sound conservation practices.

30 CFR 250.16 authorizes the Supervisor to specify the permissible production of a well. Thereafter, OCS Order No. 11 establishes the production rate control at the Maximum Efficient Rate (MER) of the well or reservoir.

30 CFR 250.17 dealing with well spacing authorizes approval of well locations, platform locations and lists factors for consideration in this regard.

30 CFR 250.30 requires lessee's compliance with OCS Orders as well as general regulations and demands all necessary precautions to prevent damage, waste and injuries.

30 CFR 250.34 requires the lessee to submit to the Oil and Gas Supervisor exploratory drilling plans, lease development plans and applications for permits to drill prior to these drilling programs. The Oil and Gas Supervisor utilizes well information such as electric well logs, core information from other wells previously drilled in the vicinity of the proposed drilling program and geological and geophysical data and other pertinent reservoir information to determine the proper number of wells necessary for development.

30 CFR 250.50 grants the Director authority to demand pooling or unitization which the Secretary is authorized to require under the OCS Lands Act in the interest of conservation.

30 CFR 250.51 refers to the unit plan regulations contained in 30 CFR 226 with regard to obtaining approval of units or cooperative agreements.

30 CFR 250.52 lists purposes for which the Supervisor may approve pooling or drilling agreements.

7. Other Requirements

In addition to the Interior Department's requirements, the operator must comply with applicable navigation and inspection laws and regulations administered by the U. S. Coast Guard. These relate to safety of personnel and display of prescribed navigational lights and signals for the safety of navigation. Permits to install islands and fixed structures and the drilling of wells from mobile drilling vessels must also be obtained from the U. S. Army Corps of Engineers, which is authorized by the OCS Lands Act to prevent obstruction to navigation. The decision as to whether a permit will be issued by the Corps of Engineers is based on an evaluation of the impact of the proposed work on the public interest. "All factors which may be relevant to the proposal will be considered; among those are conservation, economics, aesthetics, general environmental concerns, historic values, fish and wildlife values, flood damage prevention, land use classification, navigation, recreation, water supply, water quality and, in general, the needs and welfare of the people." 1/ Pipeline construction must also be in compliance with standards established by the Office of Pipeline Safety, Department of Transportation. The Department of Labor establishes Occupational Safety and Health Standards which are applicable to OCS operations.

Operators must comply with the requirements of the Federal Water Pollution Control Act Amendments of 1972 (P. L. 92-500; 86 Stat. 816) which establishes a National Pollutant Discharge Elimination System 40 CFR Part 125, 38 F.R. 13528 (1973). This system applies to

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1/ Department of the Army Permit Public Notice No. 74-547, January 6, 1975.

discharges on the OCS from any point source and requires any person to obtain a permit from the EPA for the discharge of any pollutant as defined by the Act. Discharges of any pollutant without the necessary permit from EPA is made unlawful by the Act. Pursuant to section 501 (b) of the Act, the Department of the Interior has suggested to EPA that the feasibility of a memorandum of understanding between the two agencies be considered in order to facilitate the administration of the NPDES as it applies to discharges arising from OCS lease operations and to minimize any redundancy of efforts by the Geological Survey and EPA. The feasibility is currently still under consideration.

V. UNAVOIDABLE ADVERSE ENVIRONMENTAL EFFECTS

As described throughout this statement, certain features of oil and gas operations cause adverse effects which may be considered unavoidable in the light of current operation practices, technology and regulation. Some of the effects of an oil spill, if one should occur, are considered unavoidable and are discussed below with other non-oil related impacts.

A. Effect on Marine Organisms

It is known that certain oil and gas operations result in temporary increases in turbidity. These operations include the discharge of drilling mud and cuttings and the excavation of pipeline trenches by jetting and dredging. When particulate matter is generated near the water surface, the depth of penetration of sunlight will diminish. This leads to a decrease in the output of the photosynthetic mechanism of the phytoplankton which results in a decrease in primary productivity.

The effect of any decrease in primary production must be considered as an adverse impact. The area involved is unquantifiable but very small and any reduction would only occur locally and would not involve the entire population of marine organisms.

The area to be effected from discharged drill mud and cuttings and pipeline burial cannot be quantified. Several factors determine the possible impact: drill mud composition and weight; water currents;

sea conditions; velocity of materials through disposal pipe; water depth of disposal pipe and size of pipe; type of substrate being drilled; size of drill hole and volume of cuttings; geographic location of drilling platform in Gulf of Mexico; and dispersion rate of drilling mud in water column.

For pipelines, water currents, sea conditions, water depths, bottom sediment and dispersion rate of bottom sediments in the water column must be considered. In summary, the area affected is localized within fifty feet of the particular operation throughout the water column; however, this area may decrease or increase because of the many variables involved. An estimated 50 to 100 miles of new pipeline will be associated with the development of the offered tracts.

If discharges reach the bottom in sufficient quantities, clogging of respiratory surface and filter-feeding mechanisms could probably reach a severe level in the benthic animals; physiological stress, and possible mortality could result. This impact will be encountered during pipeline jetting operations and will be restricted to the downstream direction of the bottom current. The duration of the turbidity in a given area will be no longer than a few hours.

Around each well drilled from the platform is an expanse of

cuttings, released during drilling, which has buried and smothered all non-motile benthic forms below it. The cuttings form irregular sized mounds depending on currents, etc. that make quantification difficult. If the cuttings are different in texturn and composition from the surrounding sediment, it will probably not be colonized by local forms. The significance of such a potential local populations shift is unknown.

Exposure of biota to harmful or toxic materials released into the marine environment or coastal marsh such as from accidental spills of crude oil, fuel and solvents will bring about an unquantifiable adverse effect. The effects of heavy concentrations of crude oil and petroleum derivatives, depending on their composition, consists of lethal toxicity, sublethal effects, coating with weathered oil, long term effects from tar ball formation, behavioral changes and habitat changes. The more subtle effects of chronic contamination may be serious also, but are not well understood at this time.

B. <u>Wetlands and Beaches</u>

At the present, no new pipelines are anticipated coming ashore as a result of this sale. However, should any occur, the unavoidable short-term impacts associated with trenching and backfilling for pipeline construction include the uprooting of all plants and non-motile animals in the path of the pipeline, leaving a barren strip 30 to 40 feet wide. Some slight damage may also be rendered to vegetation in adjacent areas by machinery used in the operation. The long-term impacts may include salt-water intrusion, change of floral and faunal components and possible increase of marsh erosion if the canal is not

backfilled.

In the event of an onshore oil pipeline leak or spillage at an onshore facility, it is inevitable that the vegetation would be affected according to the severity of the spill. A small leak may do little damage. A severe leak, however, may contaminate the substrate and kill the vegetation that comes into direct contact with the oil and several years may be required for recovery. Small animals in contact with the oil would likely be killed.

A considerable number of beaches and barrier islands are located throughout the area that this proposed sale encompasses. There are no tracts offered in this sale that pose a threat to recreational beaches. However, if any of these beaches are contaminated by oil, an undertermined amount of fish and wildlife habitat (primarily birds) will be damaged.

In summary, although large numbers of bird deaths from oil spills have not been documented in the Gulf of Mexico, a high possibility exists for a large number of deaths to occur should a large spill reach shore.

C. Deterioration of Air Quality

The air quality near production sites offshore may be affected should this sale proceed. Though various types of emissions will be unavoidable, they are not expected to significantly contribute to exceeding any air quality standards. In almost all cases, these emissions will be local in nature and be quickly dissipated by climatic conditions. Slight additions to the onshore air quality will result from normal operating procedures of storage, treatment and terminal facilities but should not add significantly to the pollutants already present.

If a natural gas leak or blowout occurred, degradation would be minimal. It is expected that the methane pollutants would quickly volatilize and drift away. If a fire results, pollutants would be largely carbon dioxide and water vapor. Oil leaks and oil spills not accompanied by a fire would introduce highly volatile, low molecular weight hydrocarbons, such as benzene and toluene, into the atmosphere. These lighter fractions of crude oil would undergo some unknown degree of degradation, but resultant photochemical smog is one possibility. If the spill results in a fire; large amounts of particulate carbon, and oxides of carbon, along with smaller but unknown amounts of sulfur oxides, nitrogen oxides, evaporated crude oil liquids and partially oxidized compounds, would enter the air. Local air quality would be severly degraded during the period of the fire. The degree of this cannot be determined but it is unlikely that degradation would be high enough to

effect land resources or human health. This effect, should a fire occur, would be considered adverse and unavoidable.

D. Deterioration of Water Quality

Water quality will be temporarily degragded by resuspension of sediment during pipeline construction and burial. The jetting away of the substrate from beneath the pipeline will result in suspension of sediments which may contain pollutants such as heavy metals and pesticides. The area affected will be in the direction of the current movement. Various other phases of offshore operations (emplacement of re-entry collars, blowout preventers, drilling platforms, etc.) will also cause suspension of bottom sediments in a localized area. The magnitude of deterioration depends on numerous variables, among them bottom type, currents and duration of the activity.

During drilling operations, discharged drill cuttings will adversely affect water quality. The severity of this impact depends upon such factors as the volume and type of mud discharged and the volume and type of cuttings discharged.

The production and discharge of formation waters (oil field brines) may contribute to water quality degradation when released into the Gulf. Produced formation waters may contain toxic substances, heavy metals, dissolved hydrocarbons and inorganic salts. The heavy metals may include cadmium, chromium, copper, lead, mercury, nickel and zinc, although these are generally present in trace quantities (EPA, 1974). The constituents of these brines may vary from formation to formation and within a single formation.

Water quality will also be somewhat affected by chronic pollutants and occasionally by a more significant spill.

E. Interference with Commercial Fishing Operations

As described in earlier sections, trawling operations suffer interference and inconvenience from oil and gas operations in several ways. A small portion, up to 0.02% (approximately one acre) of each tract leased, of the sea floor is occupied by drilling rigs and platforms and is unavailable to trawl fishermen. Based on past exploration success rates, up to 250 acres of sea floor, less than one percent of the total acreage offered, may be occupied by platforms resulting from this proposed sale. Trawl nets, reportedly become snagged on underwater stubs and unburied pipelines, causing damage to, or loss of, the nets. Less frequently, large objects lost overboard off petroleum industry boats and platforms are caught in trawling nets, resulting in damage to the net and/or its catch of fish. The frequency of occurrence of this type of incident is low.

Although commercial fishermen could be expected to stay out of the area of an oil spill, spilled oil could coat or contaminate commercial fish species, rendering them unmarketable. This would be another adverse effect to commercial fishing.

F. Interference with Ship Navigation

Very little interference can be expected between drilling rigs and platforms and ships that are utilizing established fairways. However, at night, and especially during rough weather, fog and heavy seas, ships not navigating the fairways could collide with

fixed structures. Also, fishing boats engaged in trawling will be inconvenienced by having to navigate around fixed structures located on fishing grounds. Based on U. S. Geological Survey estimated, 20-50 new platforms could result from this proposed sale, although the increment is small, when added to the approximately 2,040 platforms now in the Gulf of Mexico, it still represents a potential increase in possible interference with shipping.

G. Damage to Historical and Archaeological Sites, Structures, and Objects

Prior to the laying of a proposed pipeline or the drilling of an offshore well geophysical surveys will be conducted in those areas considered to have a potential for containing cultural resources. The survey records will be analyzed by an underwater archaeologist so that loss or damage of these resources may be avoided. There will still remain two possibilities for damage to underwater cultural resources. The first would arise if a cultural resource (an early shipwreck, perhaps) in encountered in an area of the shelf where expectation of its occurrence is too low to have required a pre-development underwater survey. The chance of this occurring is very low because, at the present time, all tracts leased to a depth of approximately 50 meters will require cultural resource surveys. A study is also underway which will allow for future delineation of high and low probability areas for the offshore occurrence of cultural resources. The second possibility would arise if geophysical instruments failed to record or the analysis of their records failed to interpret a cultural resource in the

area surveyed. No estimate of the probability of such an occurrence can be made at this time; however, underwater cultural surveying is a young field and the quality of instrumentation and experience of personnel is steadily improving. The probability of such destruction of cultural resources through such failure should be small and will diminish in the future.

Other damage to archaeological resources may result from oil contamination. Historical and archaeological materials soiled by an accidental oil spill may not survive subsequent cleaning and restoration efforts. Porous materials contaminated with oil would be difficult, if not impossible to use for carbon dating techniques; a significant loss of scientific knowledge may result. Although the possibility of contamination of cultural resource materials by oil spills exists, this potential is very small. Even if an oil spill occurs, it is not certain that artifacts lying on the bottom or beneath bottom sediments would be measurably affected by an oil slick covering the water above.

H. Interference with Recreational Activities

Interference with recreation is closely related to degradation of aesthetic values. Oil-contaminated beaches, freshly cut pipeline route terminals and other onshore support facilities would normally be avoided by those seeking sites for recreational activities or for recreational development. Disturbance of beaches by pipeline burial operations will be shortlived, relative to recreational use. Oiled beaches may require days, weeks or years for adequate restorations if they become damaged. The uncertainty of accidental spills is applicable to this event also, but if spilled oil ever reached the beach, it

would have an adverse effect on recreational opportunities.

The proximity evaluation printed in Section III.M. lists a number of tracts which, because of their proximity to known resources, may result in damage if 1000 bbls or more of oil were spilled and drifted toward that resource. The number of such tracts (Proximity Scale 1.) which could threaten recreational values is listed below by type of value.

Refuges/Wildlife Management Areas	3 tracts
Beaches and Shorelines	3 tracts
Aesthetics	1 tract
Archaeological Sites	33 tracts
Sport fishing	50 tracts

I. Degradation of Aesthetic Values

Platforms and drilling rigs may be located on twenty-one tracts included in this proposal lying from four to seventeen miles offshore. Some of these may be visible from shore. No new pipeline terminals or treatment facilities are expected to be constructed as a result of this proposed sale.

If such were placed to interfere with residential or recreational vistas, the visual effect would probably be considered adverse. The incremental addition to what exists in the region would be small, however. The effect, therefore, is considered minimal.

Spilled oil and debris floating in the water or washed up on the beach would also severely detract from the scenic values of any local area. Before the natural terrain and vegetation has been completely restored, the effects of pipeline burial will appear as a large scar traversing the beach and coastal lands. Restoration over most of the scar will require at least one year. If a line enters a forested shore, the corridor would be visible as long as the line is maintained and for several years thereafter. With no new lines anticipated, these effects are insignificant.

J. Conflict with Other Uses of Land

As discussed in III; K. 1. induced industrialization in the coastal zone; excess capacity in the existing gas and oil related infrastructure in the coastal zones of the adjacent states are expected to absorb most of the sale related land use inducements. A total of 0-80 acres (required for 0-2 terminal storage facilities) was iden-

tified as the only incremental land use demand induced by the sale. This acreage is very small, and there are undoubtedly alternative sites available in the general areas identified which could host such facilities. If properly sited in accordance with a comprehensive land use plan, these facilities should present no conflict with other land use.

K. Summary

In summary, all unavoidable adverse impacts that will be sustained by the natural environment as a result of routine operations will be relatively localized in their effects. Many will be followed by unhindered natural recovery within relatively short time periods. A massive accidental oil spill could result in severe and widespread damage of major consequence. Therefore, all the tracts identified for oil and gas production in this proposed sale do contain varying degrees of potential for adverse effects of several kinds. Only a massive oil spill accident is considered to result in significant adverse impact; the probability that such a spill will occur, is relatively low.

VI. RELATIONSHIP BETWEEN LOCAL SHORT-TERM USE AND MAINTENANCE AND ENHANCEMENT OF LONG-TERM PRODUCTIVITY

The principal short-term use of the proposed sale area will be the extraction of oil and gas from those tracts which prove economically productive. This mineral extraction will contribute to the diminishment of the long-term productivity of the oil and gas resources of the Gulf of Mexico and possibly to marine and coastal resources.

This proposed sale, if implemented, will add approximately 698 thousand acres (USGS estimate) to the current total of almost 7.5 million acres now under lease. This will account for 9.3% of the total area under lease after the leases of this sale are included.

There are no scientific data available in this area to indicate any trend in productivity or stress to the environment that may be occurring as a result of leasing. However, it can be stated with certainty that any additional platforms that are constructed will add to the "artificial reef" concept and may in fact be enhancing the overall productivity of the area on the long-term basis. Data from the Gulf Universities Research Consortium (1974) provided limited data that infers that no stress or inhibited productivity is occurring as a result of offshore leasing. Beyond this,it is not possible to establish any definite conclusions.

It is recognized that chronic low-level pollution from oil and toxic chemicals will have adverse impacts in certain areas. Again, it is not possible to quantify this and estimate the short or long

term affects or even the location that this may occur.

Assuming full development of the estimated platforms, approximately 250 acres would be removed from future trawling by commercial fishermen which will result in a decrease in long-term harvest to the trawl fishermen. However, the addition of the platforms will increase the long-term productivity for sport fishermen and commercial hand line fishermen. Unburied pipelines beyond the 200 foot contour will provide additional substrate for organisms to attach to and thus may increase the long-term productivity for certain benthos.

Disturbance of coastal land by pipeline construction and burial operations (including salt water intrusion) and construction of related onshore facilities (refineries, terminals, etc) would decrease productivity if any of these facilities should be constructed.

Some leveling out in the number of platforms is expected as older fields become inactive or hydrocarbon production decreases. This is also true with regard to the cumulative numbers and length (in miles) of pipeline coming ashore. In the case of pipelines, as more and more areas begin to approach termination of production, some additional capacity will be available in existing pipelines to carry production from new areas thereby reducing the numbers of new pipelines required from subsequent lease sales. It is not possible to determine at this time if the total number of platforms and pipelines required to develop the OCS areas in the Gulf of Mexico has peaked, but indications are that conditions approaching a leveling off point.

VII. IRREVERSIBLE AND IRRETRIEVABLE COMMITMENT OF RESOURCES

A. Mineral Resources

Leasing of the proposed tracts in this sale would permit development and extraction of the minerals contained therein. This lease sale could result in production of between 100-300 million barrels of oil and two-four trillion cubic feet of gas which would represent an irreversible and irretrievable commitment of mineral resources.

B. Land Resources

It has been estimated that zero-two terminal storage facilities may result from this proposed sale. This would represent a long-term use of land resources, but not an irreversible and irretrievable commitment.

C. Fish and Wildlife Resources

An irreversible or irretrievable commitment of fish and wildlife resources and their habitats could occur in the area of a massive oil spill or if frequently subjected to chronic low-levels of oil pollution. However, it is anticipated that once an area recovered from a spill that the natural fauna (excluding an endemic endangered species population) would reoccupy a vacated habitat.

D. Cultural Resources

Any damage to archaeological sites will comprise an irretrievable commitment of non-renewable resources.

VIII. ALTERNATIVES TO THE PROPOSED ACTION

A. Hold the Sale in Modified Form

1. Sale Modification Alternatives

a. Delete tracts

The proposed sale could be modified by offering only those tracts estimated to be gas producing. This would avoid some of the potential adverse environmental effects related to this proposed sale. It could significantly reduce the potential hazard to the environment from possible oil pollution events that could result from this sale as proposed.

With this modification, the proposed sale could go forward with very little, if any, adverse impacts expected as a result of oil pollution on the marine and coastal environments, resources and related activities of the area offshore.

This alternative would require the elimination of the 85 tracts estimated to be oil or oil and gas prone and would result in the loss to this sale of the 100-300 million bbl. of estimated undiscovered recoverable reserves of oil.

Development of gas prone tracts only would still require seismic exploration, exploratory drilling, construction of permanent platforms and pipelines, production well drilling, workovers, maintenance and repair work with the attendant potential adverse environmental impacts discussed in detail throughout this environmental statement for those activities. If this alternative is followed, the overall importance associated with these activities with regard to the environment would

be essentially the same as it would be if all the proposed tracts were offered. However, the magnitude of potential impacts would be reduced and the cumulative impacts associated with quantities of waste water effluents and debris, and the numbers of platforms and pipelines required to develop gas prone tracts only, would be lessened.

Tracts could be deleted which are identified by proximity evaluation as having a high hazard potential. Tracts that have a proximity evaluation of 1.0 for oil spills are considered to have a high risk potential for environmental damage. A total of 45 tracts are tentatively considered at this time to have high environmental risk potential as defined in this impact statement (see Section III, N). Four of the 45 tracts have been identified in the proximity evaluation as highly hazardous because they are located in areas of unstable bottom sediments. Deletion of these tracts would eliminate the risk of damage to a rig, an oil spill, or loss of life that might possibly occur due to this particular geologic hazard.

Acceptance of the alternative to delete all tracts identified as potentially highly hazardous would have the environmental effect of reducing the total number of platforms estimated to result if this sale proposed by approximately 2-3. It would likewise incrementally reduce the discharges and disposal of waste water, drill cuttings and muds that are estimated to occur with exploration, development and production. It is not possible at this time to determine what effect the deletion of these tracts would have on the estimated

miles and numbers of pipelines required for this sale, but acceptance of this alternative would probably have little if any affect on major lines to shore. However, it is possible that deletion of these tracts would eliminate a few, anywhere from 1-10, of the small flow lines that connect platforms with other platforms and eventually with major pipelines to shore. Acceptance of this alternative could eliminate the greatest degree of potential oil spill damage to marsh, estuarine, wildlife refuge and management areas.

Another alternative that would modify the sale would be to offer only those tracts estimated to have a low level of hazard potential to the environment. In the case of this sale, this alternative would require the deletion of 45 tracts which are considered to have a high hazard potential to the environment. Removal of tracts from this proposed offering would significantly reduce the estimated quantity of structures, drill cuttings and muds, produced waste water and activities expected to occur if this sale proceeds as proposed. The potential hazard to critical resources and use activities of the area due to impact of oil spills would be either eliminated or greatly reduced because of the location of the low hazard potential tracts to these resources and multiple use areas. This alternative would allow for reoffering the deleted tracts at a later date following a determination as to the extent of reserves in the general area.

b. Substitute tracts

Tracts with relatively lower potential environmental

risk could be substituted for those of higher potential risk. This would result in a reduction of potential environmental harm. It could also mean that, in the event a sale were held, anticipated production of oil and gas resources would not reach the production levels deemed necessary or desirable from a sale in the proposed area.

Should it be determined that greater production potential should be sought than is indicated from substitution of a similar number of tracts of relatively lower potential environmental risk and relatively lower oil and gas resource potential, a relatively larger number of tracts would have to be substituted to achieve the production activities, and could affect a relatively larger area, both offshore and onshore, than under the proposed action. It is possible that there would be more exploratory drilling, more platforms constructed, additional miles of pipelines required and a substantial increase in production activities with attendant increase in potential adverse environmental impacts discussed in detail throughout this environmental statement for these activities.

The remaining prospective tracts in the Gulf that would be available for substitution under the proposed action are, almost without exception, being considered for lease offering in the near future. Thus, a substitution of available alternate tracts might only delay, not eliminate, further leasing consideration of any tracts replaced by substituted tracts under the proposed action.

B. Withdraw the Sale

Another option is to cancel or greatly reduce the size of the proposed sale. This option would reduce future OCS oil and gas production and would thus necessitate reducing energy consumption (see Table 82.1) by reduced demand or supply shortfalls, or developing alternative energy sources, or some combination of the two.

This section briefly discussed the following alternatives:

1. Energy conservation
2. Conventional oil and gas supplied
3. Coal
4. Nuclear power
5. Oil shale
6. Hydroelectric power
7. Solar energy
8. Energy imports
   a. Oil imports
   b. Natural gas imports
   c. Liquefied natural gas imports
9. Geothermal energy
10. Other energy sources
11. Combination of alternatives

The condensed information presented in the energy alternatives section of this environmental statement are based, unless otherwise noted, on the contract study Energy Alternatives: A Comparative Analysis by the Science and Public Policy Program of the University of Oklahoma. Copies of this study are available for review in the New Orleans OCS office, in BLM's Office of Public Affairs in Washington, D. C., and can be purchased for $7.45 from the Superintendent of Documents, U. S. Government Printing Office, Washington, D. C. 20402 (Stock Number 041-011-00025-4). This study should be considered as an integral part of the alternatives portion of this EIS.

Table 82.1. Energy Needed from Other Sources to Replace the Expected Oil and Gas Production from the Proposed OCS Sale #41

1. Btu Equivalents 1/

Oil -	35,000	to	120,000	bbl/day		196		672 billion Btu/day
Gas -	0.5	to	1.1	bil. cu. ft./day	=	511	to	1123
Total						707		1795

2. Oil Equivalents in barrels per day

Oil from other sources needed to directly replace expected oil production	35,000	to	120,000	bbl/day
Oil from other sources needed to replace expected gas production	91,000	to	201,000	
Total	126,000		321,000	

1/ Conversion factors used:
- 1 barrel of oil = 5.6×10^6 Btu
- 1 cubic foot of natural gas = 1,021 Btu
- 1 ton of coal = 24×10^6 Btu
- 1 kilowatt hour = 3,412 Btu at the theoretical conversion rate of other energy forms to electricity at 100% efficiency.

Table 82.1 (continued)

3. Gas Equivalents in millions of cu. ft. per day				
Gas from other sources needed to replace expected oil production	192	to	658	mmcf/d
Gas from other sources needed to directly replace expected gas production	500	to	1100	
Total	692		1758	
4. Coal Equivalent in thousands of short tons per day	29	to	75	thousand short tons/day
5. Electrical Equivalents in thousands of megawatts of capacity				
Substitute for end uses 1/	7	to	18	thousand Mw
Substitute as input to electricity generation 2/	4	to	11	thousand Mw

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1/ Based on a 65% average efficiency of end use of oil and gas (such as oil and gas heating) and a plant load factor of 80%.

2/ Efficiency of fossil fuel electricity generation was assumed to be 40%. Efficiency of present fossil fuel generation averages about 33%.

1. Energy Conservation

Vigorous energy conservation is an alternative that warrants serious consideration. The Project Independence Report of the Federal Energy Administration claims that energy conservation alone can reduce energy demand growth by 0.7 to 1.2 percent depending on the world price of oil. Aside from these savings, it is now widely recognized that wasteful consumption habits impose social costs even as pollution and an inequitable distribution of fuel, that can no longer be afforded.

The residential and commercial sectors of the economy are often characterized as inefficient energy consumers. Inadequate insulation, inefficient heating and cooling systems, poorly designed appliances, and excessive lighting are often noticed in these sectors. To achieve reductions in consumption beyond those induced by fuel price increases could require new standards on products and buildings, and/or subsidies and incentives. These incentives could impose standards for improved thermal efficiency in existing homes and offices and minimum thermal standards for new homes and offices.

Excessive consumption is also evident in the industrial sector where energy inefficient work schedules, poorly maintained equipment, use of equipment with extremely low heat transfer efficiencies, and failure to recycle heat and waste materials are all commonplace. Estimated energy savings of between 10 and 30 percent may be available in this sector of the economy.

Transportation of people and goods accounts for approximately 25

percent of nationwide energy use. Energy inefficiency in the transportation sector varies directly with automobile usage. Automobiles, which account for 90 percent of all passenger movement in the nation, use more than twice as much energy per passenger mile as buses. Moreover, the average car carries only 1.3 passengers. Using short and mid-terms conservation measures such as consumer education, lower speed limits, rate and service improvements on public transit and rail freight transit, energy savings of 15-25 percent might be possible.

Other policies to encourage fuel conservation in transportation could include standards for more efficient new autos and incentives to reduce miles traveled. An important new development in the fuel economy area could be the modification of the standard internal combustion engine. Although such an engine is now in the advanced stages of development, further study by automotive engineers, industry, and concerned Federal Agencies is necessary before an acceptable engine may be improved.

Significant energy savings are clearly possible through accelerated conservation efforts. The Project Independence Report estimates that conservation alone could result in 2.2 million barrel per day reduction in petroleum demand by 1985. These savings will be necessary in order to achieve the goals of energy self-sufficiency.

Environmental Impacts: The environmental impacts of a vigorous energy conservation program will be primarily beneficial. The exact nature and magnitude of these impacts will depend on whether there is a net reduction in energy use of whether the reduction is accomplished

through technological change and substitutions. For the former, the net impacts will simply be that there are fewer pollutants of all kinds unleashed. As an example, the 2.2 million bbl/day savings by 1985 mentioned above would result in a diminishment of various pollutants by the following amounts. [1/]

> CO - 4 lbs/1000 gals = 189 tons/day
> Hydrocarbons - 3 lbs/1000 gals = 142 tons/day
> Particulates - 23 lbs/1000 gals = 1088 tons/day
> NO_x - 60 lbs/1000 gals = 2838 tons/day
> SO_2 - 157 lbs/1000 gals = 7426 tons/day

If, however, energy conservation is achieved by technological change or substitution, the net reductions will be those above, less the incremental pollutants from other sources, as well as any new pollutants which might arise from these other sources.

1/ HUD Contract #H2026R- "Research Evaluation of a System of Natural Air Conditioning".

2. Conventional Oil and Gas Supplies

Large supplies of oil and gas still remain in the U. S. The U. S. Geological Survey estimates that, onshore and offshore to a depth of 200 meters, crude oil measured reserves as of December 31, 1974, were 34.25 billion barrels, indicated reserves were 4.64 billion barrels, inferred reserves were 30 billion barrels, and undiscovered recoverable resources ranged from 50 billion barrels with a 95% probability to 127 billion barrels with a 5% probability.

Despite the magnitude of reserves, domestic oil production is likely to continue to decline. All of the twelve oil production forecasts discussed in the Project Independence Blueprint claimed that, in the next few years, the U. S. petroleum production decline would continue. Most of these same forecasts predict increasing domestic production by the late 1970's, but only under the most favorable conditions in terms of prices, regulations and environmental constraints.

To substitute directly for the proposed sale, onshore oil production would have to increase by 35 to 120 thousand barrels a day and onshore gas production by 0.5 to 1.1 billion cubic feet a day.

Conventional gas supplies are expected to decline also. The development of new reserves required to meet gas demand will depend on continued development of onshore areas and of commercially viable nuclear stimulation or massive hydraulic fracturing to produce natural gas from low permeability reservoirs.

Environmental impacts of oil and gas development may include land

subsidence; soil sterilization due to oil, brines, and waste materials released by blowouts, equipment failure, and human error; disturbance of land by building roads and structures; and pollution of ground and surface water due to poor well construction and spills.

3. Coal

Coal is the most abundant energy resource in the United States. Coal deposits underlying nearly 460,000 square miles in 37 states constitute one-quarter of the known world supply and account for 80 percent of our proven fuel reserves.

To replace the energy expected to be realized from the proposed sale, 11 to 27 million tons of coal per year would be necessary. Though domestic reserves could easily provide this quantity, serious limitations to coal development exist. In many uses, coal is an imperfect substitute for oil or natural gas. In many other cases, coal use is restricted by government constraints; limited availability of low sulphur deposits; inadequate mining, conversion, and pollution abatement technology; and the adverse environmental impacts associated with coal extraction and electricity generation from coal. Coal production is also faced with mining labor problems and strict standards for coal mine safety.

As with other extractable hydrocarbons, the quantity of available coal is a function of coal's market price. Current increase in the market price for coal are making more of the resource base available for domestic consumption.

Public concern over dangerous underground mine conditions inspired the Federal Coal Mining Health and Safety Act of 1969. This legislation has improved underground mining conditions and therefore has reduced the hazards to coal miners. On the other hand, it has also increased the costs of underground coal mining and given strip mining

a competitive advantage over underground mining. Strip mining is far less hazardous than underground mining and hence is subject to fewer of the provisions and regulations of this act.

New, strict air quality regulations have diminished the attractiveness of coal. One-third of the domestic coal reserve does not meet the low-sulphur requirement. The two-thirds of this reserve that is environmentally acceptable is located mainly in the Rocky Mountain states and is generally of lower BTU value than eastern coals. The cost of transporting Rocky Mountain coal to population centers of the eastern or western United States adds significantly to its price, putting much of it at a competitive disadvantage with other energy sources.

a. <u>Coal gasification and liquefaction</u>

Technology for conversion of coal into gaseous and liquid hydrocarbons has been established for several decades and a number of relatively low-capacity commercial plants exist in various parts of the world. However, few cost-effective advanced technologies have advanced beyond the pilot plant stage.

Numerous problems remain before commercial development of synthetic fuels from coal can proceed. Specific technical problems must be solved. The cost-effectiveness of synthetic fuels from coal will depend on prices of other fuels, primarily oil and natural gas. Control of adverse environmental effects will increase the cost of producing synfuels. Possible constraints on development include resource constraints: availability of skilled workers, raw materials (coal,

water, steel), capital; and institutional constraints: government policies (energy resource leasing, coal mining regulations, permit procedures, etc.), and willingness of industry to invest in development of new technologies.

Coal gasification is accomplished by reacting solid coal with steam, oxygen, air, hydrogen, or mixtures of these gases, to produce first a raw gas containing methane, carbon monoxide, hydrogen, carbon dioxide, steam, hydrogen sulfide, and ammonia in varying proportions depending upon the process. This raw gas is then processed to reduce or enhance certain of these constituents in order to prevent environmental pollution and to produce the type of gas needed for a particular use.

Gaseous fuels with low, intermediate, or high energy content can be produced. Low and intermediate gasses are produced in a two stage process involving preparation and gasification; a third process, upgrading, is required to produce high-Btu gas.

Among low-Btu gasification processes under development are: Lurgi, Koppers-Totzek (both in commercial use), Bureau of Mines Stirred Fixed Bed and Westinghouse Fluidized Bed. Among high-Btu gasification processes are: Lurgi high-Btu gasification process, HYGAS, BI-Gas, Synthane, CO_2 Acceptor.

<u>Coal liquefaction</u>: As with coal gasification, production of liquid fuels from coal requires either addition of hydrogen or removal of carbon from the compounds in the coal. Coal liquefaction

can be viewed as a change in the carbon to hydrogen ratio that can be accomplished one of three reactions: hydrogenation, pyrolysis, or catalytic conversion. Of these, only the last is in commercial operation. Among liquefaction processes under development are: Synthoil, H-Coal, Solvent Refined Coal, Consol Synthetic Fuel, COED, TOSCOAL, and Fischer-Tropsch.

The primary environmental impacts of coal begin with coal mining. Underground mining may cause land subsidence. Strip mining and open pit mining disrupt large surface areas, causing destruction of the top soil, wildlife habitats and vegetation. Large volumes of mine wastes must be disposed of. Water quality problems may arise from damage to the ground water regime, acid mine drainage, and increased runoff and sediment loads in streams. Stripping increases the dust in the air. Combustion of coal, especially high sulphur coal, releases particulate and gaseous pollutants. Technology to control the pollutants is not completely developed.

4. Nuclear Power

The predominant nuclear system used in the U. S. is the uranium dioxide fueled, light water moderated and cooled nuclear power plant. Research and development is being directed toward other types of reactors, notably the breeder reactor and fusion reactors.

As of March 31, 1975, fifty-three nuclear plants with capacity of 35,000 MW, were licensed to operate. At the end of 1974, nuclear power generated about 8 percent of the Nation's electricity. However, about half of the electric power capacity now under construction is nuclear powered. Nuclear power development has encountered delays in licensing and siting, environmental constraints, and manufacturing and technical problems. Future capacity will be influenced by the availability of plant sites, plant licensing considerations, environmental factors, nuclear fuel costs, rate of development of the breeder and fusion reactors, and capital costs. In order to meet future uranium requirements, an increase in exploratory drilling activity will be necessary.

The nuclear capacity required to generate electricity to substitute for OCS sale production is shown below for two cases:

a. all of the OCS oil and gas were used to generate electricity

b. all of the OCS oil and gas were devoted directly to end uses such as oil and gas heating.

Nuclear capacity required to substitute for the electricity which could be generated by the projected oil and gas from sale #41 would be 4 to 11 1,000-MW plants.

Capacity required to substitute for end uses would be 7 to 18 1,000-MW plants. The required amounts of nuclear fuel are shown below for both cases, assuming model 1000-MW light water reactors.*

	4 to 11 1,000-MW Light Water Reactors	7 to 18 1,000-MW Light Water Reactors
(1) tons U238 first core fuels - first year only 1/	2,320 - 6,380	4,060 - 10,440
(2) thousands of tons of uranium ore required for (1) 2/	1,160 - 3,190	2,030 - 5,220

* This comparison has several limitations, among them the difference in lifetime between an OCS oil and gas field (15-20 years) and a nuclear powerplant.

1/ Assuming 80 percent plant factor.

2/ Assuming 0.20 percent average ore grade.

(3) tons U238 annual reloads without plutonium recycling	800 - 2,200	1,400 - 3,600
(4) thousands of tons of oranium ore required for (3)	400 - 1,100	700 - 1,800
(5) tons U308 annual reload with plutonium recycling	700 - 1,925	1,225 - 3,150

	4 to 11 1,000-MW Light Water Reactors	7 to 18 1,000-MW Light Water Reactors
(6) thousands of tons of oranium ore required for (5)	350 - 963	613 - 1,575
(7) acres of land required for sites only 1/	4,000 - 11,000	7,000 - 18,000
(8) cubic feet of high level solid wastes produced yearly	300 - 825	525 - 1,350

Although nuclear plants do not emit particulates or gaseous pollutants from combustion, the potential for serious environmental problems exists. Some radioactivity in the form of radiation, airborne radioactivity, and radioactive liquids, is released to the environment. Although the amount released is very small and potential exposure has been shown to be less than the average level of natural radiation exposure, special precautions are required to control these emissions. The possible release of radioactivity as a result of an accident must be anticipated in the design of the plant and its emergency systems. Malfunction of the emergency core cooling system has been of particular concern.

Nuclear plants use essentially the same cooling process as fossil-fuel plants and thus share the problem of heat dissipation from cooling water. However, light-water reactors require larger amounts of cooling

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1/ Assuming a normalized 1000 acres per 1000 MW light water reactor. Of this, 12 acres per year is non-reclaimable.

water and discharge greater amounts of waste heat to the water than comparably sized fossil-fuel plants. The effects of thermal discharges may be beneficial in some cases. Adverse effects can be mitigated by use of cooling ponds or cooling towers.

Low level radioactive wastes from normal operation of a nuclear plant must be collected, placed in protective containers, and shipped to an AEC storage site and buried. High level wastes created within the fuel elements remain there until the fuel is spent. They are then isolated in a fuel reprocessing plant and stored in liquid or solid form at AEV facilities.

Primary residuals from light water reactors are waste heat and radioactive emissions.

For a 1000-MW plant operating at a 75% load factor, a 32% efficient nuclear plant would emit 47.6×10^{12} Btu's of waste heat annually. For comparison, a 38% efficient fossil fuel plant would emit 36.5×10^{12} Btu's of waste heat. Annual radioactive emission for both types of light water reactors (boiling water reactor and pressurized water reactor) are given below.

Annual Radioactive Emissions
for a 1,000 Mw LWR

Radioactive Gas	BWR (curies)	PWR (curies)
Tritium (H_3)	10	50
Iodine (I_{131})	0.3	0.8
Noble Gas (Krypton and Xenon)	50,000	7,000

Source: Teknekron, Inc., 1973, Fuel Cycles for Electrical Power Generation, Phase I: Towards Comprehensive Standards: The Electric Power Case, for Office of Research and Monitoring, Environmental Protection Agency. Berkeley, California.

5. Oil Shale

The nation's vast oil shale resources have not been developed in the past because of the ready availability of low cost oil and gas. However, current needs have given impetus to oil shale development.

Oil shale can be processed in place (in-situ processing) or can be extracted using surface or underground mining and then processed on the surface.

The Green River Formation covering parts of Colorado, Utah, and Wyoming contains an estimated 600 billion barrels of oil shale, the richest deposits in the U. S. An estimate 73% of oil shale lands, containing nearly 80% of the Green River Formation reserves, are federally held. The Department of the Interior, which manages these federal lands, has initiated a prototype oil shale leasing program to make these rich deposits available for development by private industry.

Oil shale development poses serious environmental problems. With surface or conventional underground mining, it is very difficult to dispose of the huge quantities of spent shale, which occupy a larger volume than before the oil was extracted. Inducing revegetation in an area of oil shale development is difficult and may take more than ten years. In-place processing avoids many of these environmental hazards. However, both methods could cause disturbance of underground aquifers and contaminations of ground waters.

Commercial development of the Green River Formation would require significant quantities of water in an area where water availability is already a problem.

The Green River Formation area is sparsely settled. Oil shale development would cause major changes in existing land uses and thus have social and economic repercussions in an area traditionally devoid of large scale industry. It would also disturb wildlife. The Colorado oil shale lands have some of the largest migratory deer and elk herds in the world.

Roads, mining plant sites, waste disposal areas, and utility line corridors would disrupt the land's vegetation cover and intensify sediment loads in the area's streams. Disposing of the huge volume of waste water containing dissolved inorganic and organic compounds without degrading natural ground waters would severely strain the region's already scarce water resources. Oil shale mining would raise noise pollution levels and the attendant particulate emissions would lower ambient air quality.

6. Hydroelectric Power

Hydropower is energy from falling water, which is used to drive turbines and thus produce electricity. Conventional hydroelectric developments convert the energy of natural regulated stream flows falling from a height to produce electric power. Pumped storage projects generate electric power by releasing water from an upper to a lower storage pool and then pumping the water bank to the upper pool for repeated use. A pumped storage project consumes more energy than it generates but converts off-peak, low value energy to high value peak energy.

Many of the major hydroelectric sites operating today were developed in the early 1950's. Thirty to forty years ago, hydroelectric plants supplied as much as 30% of the electricity produced in the U. S. Although hydro plant production has steadily increased, thermal-electric plant production has increased at a faster rate.

As of May 1974, total conventional hydropower developed in the contiguous U. S. was 54,885 megawatts, nearly one half of which was in the western states of Washington, Oregon and California. Some 6,878 megawatts of conventional hydro capacity are now being installed, about 90% of which is in the western part of the country.

Much of recent hydroelectric development has been pumped storage capacity. As of May 1974, the total developed pumped storage capacity in the contiguous U. S. was 8,119 megawatts; capacity under construction was 6,253 megawatts. Over 30% of both developed capacity and capacity under construction is in the Middle Atlantic region.

The undeveloped potential for hydroelectric generation is about 93,000 megawatts in the lower 48 states and about 32,000 in Alaska. However, it is likely that hydroelectric power will represent a declining percentage of the total U. S. energy mix due to the following: high capital costs, seasonal variations in waterflows, land use conflicts, environmental effects, water use and flood control constraints. Sites with the greatest production capacity and lowest development costs have already been exploited.

Construction of a hydroelectric dam represents an irreversible commitment of the land resource beneath the dam and lake. Flooding eliminates wildlife habitat and prevents other uses such as agriculture, mining, and free-flowing river recreation.

Hydroelectric projects do not consume fuel and do not cause air pollution. However, use of streams for power may displace recreational and other uses. Water released from reservoirs during summer months may change ambient water temperatures and lower the oxygen content of the river downstream, adversely affecting indigenous fish. Fluctuating reservoir releases during peak load operation may also adversely affect fisheries and downstream recreation.

Fish may die from nitrogen supersaturation, which results at a dam when excess water escapes from the draining reservoir. High nitrogen levels in the Columbia and Snake rivers pose a threat to the salmon and steelhead resources of these rivers.

The quantity of hydroelectric energy needed to substitute for the oil and gas expected from the proposed sale depends on whether the oil

and gas were used directly for purposes such as heating or if it were burned to produce electricity, an indirect use. Since direct use is more efficient, substitution in this instance would require a larger quantity of hydroelectric energy versus the case where oil and gas were used to produce electricity.

To substitute for end uses, 7-18 thousand megawatts per day of hydroelectric energy would be needed. To substitute for the electricity which could be generated by the oil and gas, 4-11 thousand megawatts of capacity would be needed.

However, hydroelectric power cannot be substituted for oil and gas in non-transportation uses or in industrial uses that depend on the unique properties of oil and gas. Land use priorities often inhibit development. Furthermore, few dams are built solely for hydroelectric power generation. Irrigation, navigation, minicipal and industrial uses, and flood control are frequently more important than and not fully compatible with power production needs. Since hydropower is most often used to service peak loads, other energy sources must be relied on for base power loads.

7. Solar Energy

Energy from the sun can be used to heat or cool individual buildings and to generate electricity. In the 1940's and 1950's, prior to the availability of low cost natural gas, firms selling solar water heaters did a booming business in California and Florida. Commercially installed solar heating and cooling in homes will be in use in many parts of the nation by 1985 and will be common by 1993. Moreover, intensifying current research and development could hasten these dates by five years (Morrow, 1973). Solar energy will eventually supply 35 to 50 percent of the nearly 20 percent of the nation's energy that is now devoted to space conditioning, thus reducing significantly the peak electricity demands of the summer months.

Applications of solar energy must take into account the following:

(a) Solar energy is a diffuse, low intensity source.

(b) Its intensity is continuously variable with time of day, weather, and season.

(c) Its availability differs widely between geographic areas.

Potential application of solar energy show a wide range. Among them are:

Thermal energy for buildings

Water heating, space heating, space cooling, combined systems

Renewable clean fuel sources

Combustion of organic matter

Bioconversion of organic materials to methane

Pyrolysis of organic materials to gas, liquid, and solid fuels

Chemical reduction of organic materials to oil

Electric power generation

Thermal conversion

Photovoltaic - residential/commercial, ground central station, space central station

Wind energy conversion

Ocean thermal difference

Because of the energy situation, congressional interest in solar energy research has intensified. The Solar Heating and Cooling Demonstration Act of 1974 legislates a $60 million demonstration program aimed at proving the commercial feasibility of solar $5,000-$6,000 (including costs of a standby conventional furnace) compared to $1,000-$2,000 for a conventional fossil-fuel home heating unit. However, the rising cost of the gas and oil needed by the conventional heaters means that the initial difference in fixed costs will quickly be overshadowed by the solar systems' lack of fuel costs. Therefore, though more costly at first, the solar unit will be the economical alternative over time.

Additionally, technological change could reduce cost. For instance, one demonstrated direct use of solar energy to heat and cool individual buildings appears to be very successful according to a recently completed study. This study called "Research Evaluation

of a System of Natural Air Conditioning" was completed by a professional group from California Polytechnic State University under contract to the Department of Housing and Urban Development (Contract No. H2026R). In part this report states:

> "Results have shown that this system with minor modifications discovered by this evaluation, is workable from an architectual, a thermal, an economic, and occupancy standpoint at the present time, and that this system could play an important role in energy conservation in the United States without further prototype development."

What is particularly significant about this scientific report is that it was completed on an occupied California home (Atascadero). It needed no backup system and further more used no oil, gas or electricity for heating or cooling throughout a year in which outside temperature ranged from 26° to 99° F. During this period the report states that the indoor temperature at the five foot level cycled less than 4° F. daily and the system (Skytherm) 1/ was able to keep the indoor temperature between the extremes of 66° F. and 74° F except during special test periods or times of prototype breakdown.

1/ "Skytherm" Systems were invented and patented by Harold R. Hay of Los Angeles, California.

Another excerpt from this report states:

> "Assuming that the system can be built with no premium, a 1,500 sq. ft. house costing $30,000 on a $6,000 lot carrying an 8 percent mortgage of $28,000 on which $20.00/month of utility cost saved is applied as additional payment, would have its loan period reduced from 25 to 19.7 years with an interest saving of about $13,600. If a $30/month utility reinvestment is made possible, the interest saving is about $17,500.

With this system's "zero" energy consumption, compared to conventional heating and cooling costs, it is appropriate to calculate the saving in fuel consuption at the point of electricity generation. Production of one KWHR of electricity requires about 13,656 BTU (assuming a 25% rate of efficiency in production and transmission). If one barrel of fuel oil (42 gallons) can produce 6,250,000 BTU then Skytherm in Atascadero is conserving approximately 20 barrels of fuel for annual heating and approximately an additional 10 barrels of fuel for cooling equalling an annual total saving of about 30 barrels.

The faster solar-conditioned houses are added to the housing inventory the greater their input on the total energy consumption for the United States. If, for instance, over a period of 40 yeras, Skytherm type houses are build at an average rate of 50,000 units per year, the 2 million units will represent 2% of a 100 million total at the end of that period. To the extent that

residential use continues to represent about 40% of the national energy consumption, the saving attributable to these type houses would be .8% of the national total.

In terms of air pollution, a saving of 1,500,000 1/ barrels (63,000,000 gallons) annually, would cause the following reductions in air contaminants 2/:

Carbon monoxide	252,000 lbs.
(4 lbs. per 1,000 gallons)	
Hydrocarbons	189,000 lbs. ann.
(3 lbs. per 1,000 gallons)	
Particulate matter	1,449,000 lbs. ann.
(23 lbs. per 1,000 gallons)	
Oxides of nitrogen	3,780,000 lbs. ann.
(60 lbs. per 1,000 gallons)	
Sulphur dioxide	9,891,000 lbs. ann.
(157 lbs. per 1000 gallons) 3/."	

Presently this system has only been proved (according to the report for the Southwest but other "Skytherm" Systems have been conceived for other climates and are in the early development stages.

1/ Assuming one years construction of 50,000 homes at a savings of 30 barrels per year.

2/ The reduction vary according to the grade of fuel being burned.

3/ This amount may vary according to the sulphur content of the fuel being burned.

Other new developments have been undertaken in the State of Colorado with rapid growth in Solar homes and office buildings. On the outskirts of Colorado Springs a 30 million dollar hospital complex is being built and will have a 1 million dollar solar heating system. The initial outlay is high but a city official feels that the savings in fuel over a six year period should pay for the system. 1/ The city is also requesting Federal financial assistance to install a single central bank of solar collectors to heat 54 low income hours. 1/

The full potential of solar energy can be realized only after large-scale generation of electricity using solar energy becomes technically and economically feasible. In this regard the Ford Administration has requested $33 million for solar electricity programs in fiscal 1975 - almost $26 million more than the fiscal 1974 appropriation. A number of technical and engineering problems now prevent commercialization of solar steam-electric plants though pilot projects are well underway. It is estimated that solar electricity will be available on a significant scale in 10-15 years. (As a comparison, peak production from the intended OCS sale #35 will occur eight years after leases have been issued).

1/ U.S. News and World Report, June 2, 1975.

Solar energy does have a few disadvantageous aspects--high capital costs, expensive maintenance or solar collectors, thermal waste disposal, and distortion of local thermal balances being the most prominent.

The accelerating real costs of fossil-fuel will continue to increase the attractiveness of the solar energy option. In addition, the environmental impacts of solar energy are relatively less severe than those imposed by the traditional energy sources.

Solar erergy cannot substitute for petroleum in all uses, transportation and petrochemicals being the most evident examples. However, as solar energy is used with increasing frenquency for heating and electricity generation, oil and gas supplies previously devoted to heating and electricity will be channelled to the petrochemical and transportation industries and other exclusive uses of oil and gas.

8. Energy Imports

a. Oil imports

U. S. Reliance on imported oil has increased steadily in the last decade. Competition on the world market and cutbacks in Middle Eastern oil exports have raised questions about availability of oil imports in the future. Declining resource availability and increasing domestic demand restrict potential imports from the Western Hemisphere, particularly Latin America. Increasing imports from the Middle East bring problems of security of supply, balance of payments, U. S. off loading capacity, and refinery capacity.

In January 1975, imports of petroleum and petroleum products were 285,457,000 barrels at a total cost of $3.3 billion. Average cost per barrel was $11.58. Imports fell in February 1975 to 155,537,000 barrels at a total cost of $1.8 billion. Average cost per barrel was $11.63. This was the lowest import level since March 1974, when cost of imports was $1.77 billion.

To replace the estimated oil and gas from the proposed sale would require oil imports of 126,000 to 321,000 barrels a day; at $11 per barrel, these imports would cost $1.39 to $3.54 million a day; at $7 per barrel, these imports would cost $.88 to $2.25 million a day.

Increasing petroleum imports in lieu of OCS development would be contrary to U. S. goals of greater energy self-sufficiency.

The primary environmental hazard of increased oil imports is the possibility of oil spills, which can result from intentional discharge, accidental discharge, and tanker casualties. Intentional discharges

would result largely from tank cleaning operations. The effects of chronic low-level pollution are largely unknown. The worldwide tanker casualty analysis indicates that, overall, an insignificant amount of the total volume of transported oil is spilled due to tanker accidents. However, a single incident such as the breakup of the Torrey Canyon can have disastrous results. With increasing tanker traffic in already crowded harbors, the probability of such an incident is increased.

b. Natural gas imports

Imports of natural gas via pipeline have come largely from Canada, with small amounts from Mexico. In 1973, net pipeline imports from Canada were 1,012 Bcf, about 4.2% of the total natural gas used in the U. S. These imports were about 45% of Canada's natural gas production. Natural gas pipeline imports from Mexico have not been a significant part of U. S. supply. In 1973, imports from Mexico were 1.6 Bcf.

Mexico is not likely to be a significant source of future imports because of its relatively small natural gas resource base, its policy of self-sufficiency in energy, and the small volume of current U. S. imports from Mexico. Imports from Mexico were of a local nature until 1957 and have declined since 1969.

The environmental impacts of increasing gas imports derive mainly from the possible increased use of land for pipeline construction. A further impact is the risk of explosions and fires.

To replace the oil and gas estimated from the proposed sale would require imports of 692 to 1,758 million cf per day. It is

uncertain whether increased quantities of natural gas will be available for import from either Canada or Mexico. Canadian intentions to gradually phase out oil exports to the U. S., also put into question increased natural gas pipeline exports.

c. Liquefied natural gas imports

The growing shortage of domestic natural gas has encouraged projects to import liquefied natural gas (LNG) under long term contract. Large scale shipping of LNG is a relatively new industry. Several LNG projects are now under consideration on the Pacific, Atlantic and Gulf coasts. However, the Middle East oil cutback has raised questions concerning the security of foreign LNG. The complexity of and length of time involved in implementing these proposals has been increased by the need for negotiating preliminary contracts, securing the approval of the Federal Power Commission and the exporting country, and making adequate provision for environmental and safety concerns in the proposed U. S. facilities.

The environmental impacts of LNG imports arise from tankers; terminal, transfer and regasification facilities; and transportation of the gas. The primary hazard of handling LNG is the possibility of a fire or explosion during transportation, transfer, or storage.

Receiving and regasification facilities will require prime shoreline locations and dredging of channels. Regasification of LNG will release few pollutants to the air or water.

LNG imports will influence the U. S. balance of payments. This impact will depend on the origin and purchase price of the LNG, the

source of the capital, and the country (U.S. or foreign) in which equipment is purchased and LNG tankers are built.

Replacement of the estimated oil and gas production from the proposed sale would entail importing the equivalent of 692 to 1,758 million cf per day.

9. Geothermal Energy

Geothermal energy is primarily heat energy from the interior of the earth. It may be generated by radioactive decay of elements such as uranium or thorium and fraction due to tidal and crustal plate motions.

There are four major types of geothermal systems: hot water, vapor dominated, geopressured reservoirs, and hot dry rock systems.

Geothermal plants are smaller than conventional plants and require a greater amount of steam to generate the same amount of electricity. This is due to the fact that temperatures and pressures associated with geothermal areas are lower than those created at conventional power plants.

The greatest potential for geothermal energy in the U. S. is in the Rocky Mountain and Pacific regions; some potential exists in the Gulf Coastal Plains of Texas and Louisiana. The Geysers field in California is the most extensively developed source of geothermal energy in the U. S. It has been producing power since 1960. Exploration efforts are also underway in the Imperial Valley, Salton Sea, Mono Lake and Modoc County, California.

Within 20 years, geothermal energy may account for about one to two percent of total U. S. energy and about five percent of California's total energy consumption.

To substitute for end uses of the estimated oil and gas from the proposed sale, 7 - 18 thousand megawatts of geothermal capacity would be needed. To substitute for the electricity which could be generated

by the estimated oil and gas, 4 - 11 thousand megawatts of capacity would be needed.

A number of gases are associated with geothermal systems and may pose health and pollution problems. These gases include ammonia, boric acid, carbon dioxide, carbon monoxide, hydrogen sulfide, and others. However, adverse air quality impacts are generally less than those associated with fossil-fuel plants. Also associated with geothermal energy systems are saline waters which must be disposed of, and isolated from contact with ground water regimes.

Land quality problems stem from disturbance due to construction of related facilities, and possible ground subsidence which in turn can cause structural failures and loss of ground water storage capacity.

10. Other Energy Sources

The high costs and rapidly shrinking reserves of the traditional energy fuels have encouraged research into new and different sources for potential energy. Some of these alternate sources have been known for decades but high costs and technical problems have prevented their widespread use.

Environmental impacts of these alternatives are difficult to assess, especially if a great amount of research and development remains to be completed before operational scale systems can be developed, tested and evaluated for production and application.

For the alternatives listed below, the date of commercial availability will depend on the cost of the traditional energy fuels, the level of federally-subsidized research, and the solution of engineering and technical problems.

Federal energy research and development funding has expanded significantly in the last few years. Tables 82 and 83 shows funds for different areas of research.

Table 82

Program Area	74 BA	74 BO	75 BA	75 BO	76 BA	76 BO	T.Q BA	T.Q BO
Conservation	25.4	8.6	45.5	31.8	64.1	58.4	14.7	12.7
End Use	–	–	–	–	5.0	3.0	1.0	1.0
Transmission	3.0	1.5	12.6	6.6	13.8	13.1	2.5	2.8
Conversion	10.9	3.8	21.4	14.7	25.0	24.4	6.5	4.5
Storage	1.7	1.5	6.6	5.6	10.1	9.0	2.0	2.1
Automotive	9.8	1.8	4.9	4.9	10.2	8.9	2.6	2.3
Oil, Gas, & Shale	11.8	11.3	33.1	21.2	36.0	32.5	9.7	9.8
Oil & Gas	3.1	2.6	23.7	13.6	23.9	21.0	5.9	6.2
Oil Shale	3.3	2.8	5.1	2.5	9.4	8.4	2.4	2.4
Related Prog.	5.1	6.0	4.0	3.7	2.4	2.7	1.4	1.1
Trust Funds	.2	-.1	.3	.4	.3	.4	.1	.1
Coal	134.5	69.9	296.3	186.3	346.8	293.2	93.9	51.0
Combustion	15.5	3.5	35.9	20.7	38.1	32.6	14.8	5.1
Liquefaction	46.3	19.8	107.7	57.6	97.6	96.9	28.8	16.0
Gasification-Hi BTU	33.3	29.4	64.4	62.4	63.4	42.8	10.5	8.7
Gasification-Low BTU	22.1	8.4	52.0	17.8	45.4	51.7	11.4	6.5
Demo Prog.	–	–	–	–	57.0	27.1	17.0	7.6
Other	9.9	1.5	23.3	14.8	35.4	32.1	8.9	4.6
Trust Funds	7.3	7.3	13.0	13.0	10.0	10.0	2.5	2.5
Environmental Control (Thermal Pollution)	0.2	0.2	2.3	1.8	4.9	4.1	1.4	1.2
Fisson	503.3	483.2	697.3	618.2	770.5	681.1	177.9	210.9
LMFBR	363.2	353.6	497.2	447.5	544.0	470.0	117.2	137.2
Other Breeders	2.5	3.6	13.7	9.8	11.6	12.4	3.0	3.1
HIGR	14.9	13.1	39.0	23.1	35.0	36.6	8.8	9.8
LWBR	31.6	28.3	36.9	35.7	35.1	37.9	11.1	9.4
Waste Management	10.8	7.8	16.0	14.2	22.4	20.9	6.7	5.9
Uranium Enrichment	64.9	63.1	72.3	73.4	74.2	78.7	22.3	20.6
Other	15.4	13.7	22.2	14.5	48.2	24.6	8.8	24.9
Fusion	112.2	99.0	179.6	146.7	225.5	214.0	72.0	60.0
Solar, Geothermal Others	18.7	11.5	71.0	26.8	101.6	92.6	27.8	19.5
Solar	7.9	4.0	38.4	8.8	70.3	57.1	20.7	14.8
Geothermal	9.4	6.4	28.1	14.5	23.4	28.9	5.2	3.2
Systems Studies	1.1	.9	3.9	3.0	7.3	6.0	1.6	1.3
Miscellaneous	.3	.2	.6	.5	.6	.6	.3	.2
TOTAL DIRECT	806.1	683.7	1325.1	1032.8	1549.4	1375.9	397.4	365.1
Environmental Effects	88.5	88.1	139.9	115.0	146.1	140.9	36.6	36.5
Basic Research	114.7	115.6	143.0	135.1	152.0	144.9	41.6	38.6
Total Supporting	203.2	203.7	282.9	250.1	293.1	285.8	78.2	75.1

NON-ERDA ENERGY R&D
(in millions)

Table 83

Program Area: Agency		74 BA	74 BO	75 BA	75 BO	76 BA	76 BO	T.Q. BA	T.Q. BO
CONSERVATION		20.7	18.0	32.4	22.5	23.7	24.4	5.3	5.1
End Use:	DOC	4.2	3.9	2.9	3.1	2.7	2.6	.6	.6
Transmission:	NSF	1.7	1.2	1.2	.7	–	1.0	–	–
Conversion:	NSF	1.2	1.1	4.5	2.0	2.0	2.0	.3	.3
	NASA	.4	.4	.4	.4	.4	.4	.1	–
Storage:	NSF	1.9	1.6	7.5	3.0	2.0	1.7	.3	.2
	DOI	–	–	.3	.3	.3	.3	.1	.1
Automotive:	NSF	.9	.6	.9	.5	1.0	1.0	.3	.3
	DOT	2.2	1.4	6.5	4.5	7.0	7.0	1.7	1.7
	NASA	1.9	1.9	.9	.9	1.0	1.0	–	–
	DOD	3.9	3.9	5.1	5.1	5.1	5.0	1.3	1.3
	EPA	2.4	2.0	2.2	2.0	2.2	2.2	.6	.6
OIL, GAS, SHALE		.3	.3	6.4	7.3	6.6	5.3	1.6	1.6
Oil & Gas	NSF	.1	.1	.3	.1	.5	.3	.1	.1
Oil Shale:	DOI	–	–	5.6	6.9	5.6	4.6	1.4	1.4
	NSF	–	–	.3	.1	.3	.2	.1	.1
Related:	DOC	.2	.2	.2	.2	.2	.2	–	–
COAL		8.4	8.2	49.8	37.8	49.4	49.2	13.2	14.4
Mining:	DOI	7.5	7.5	42.2	31.3	42.2	42.2	11.8	12.8
Direct Combustion:	NSF	–	–	1.2	.9	1.0	.9	.2	.3
Liquefaction:	NSF	.3	.2	.9	.6	.8	.8	.2	.2
Gasification-Hi:	DOC	.2	.2	.2	.2	.2	.2	–	–
Gasification-Lo:	NSF	.3	.2	.9	.6	.8	.7	.2	.2
Other	AGRI	–	–	3.8	3.8	3.8	3.8	.7	.7
	NSF	.1	.1	.6	.4	.6	.6	.1	.2
ENVIRONMENT		65.6	58.1	101.0	34.0	78.0	90.0	22.1	25.1
	EPA	65.5	58.0	99.0	32.0	73.0	85.0	22.0	25.0
	DOI	.1	.1	2.0	2.0	5.0	5.0	.0	.1
FISSION		48.6	47.1	64.9	60.2	106.4	95.5	24.5	23.6
LMPBR:	DOC	1.0	1.0	1.0	1.0	1.0	1.0	.2	.2
Other:	DOI	–	–	1.1	1.1	1.1	1.1	.2	.2
Safety:	NRC	47.6	46.1	62.8	58.1	104.3	93.4	24.1	23.2

(continued)

NON-ERDA ENERGY R&D
(in millions)

Table 83 (continued)

		74		75		76		T.Q.	
		BA	BO	BA	BO	BA	BO	BA	BO
Program Area: Agency									
SOLAR, GEOTHERMAL OTHER		26.7	7.9	31.2	27.5	15.8	23.0	3.4	2.6
Solar:	NSF	14.8	3.7	10.0	14.2	3.0	8.2	.5	.5
	AGRI	–	–	1.2	1.2	1.2	1.2	.3	.3
	NASA	.9	.9	.9	.7	.3	.2	.1	–
Geothermal:	NSF	3.6	.1	6.0	4.8	2.0	5.1	.5	.1
System Studies:	NSF	6.0	2.0	9.5	3.0	5.5	4.5	1.0	.7
Resource Assessment:	DOI	.1	.1	.8	.8	.8	.8	.2	.2
Miscellaneous:	NSF	.4	.4	1.0	1.0	1.0	1.0	.3	.3
	DOI	.7	.7	1.8	1.8	2.0	2.0	.5	.5
TOTAL DIRECT		170.1	139.6	285.7	189.3	279.9	287.4	70.1	72.4
	NRC	47.6	46.1	62.8	58.1	104.3	93.4	24.1	23.2
	EPA	67.9	60.0	101.2	34.0	75.2	87.2	22.6	25.6
	DOI	8.4	8.4	53.8	44.2	57.0	56.0	14.3	15.3
	NSF	31.3	11.3	44.8	31.9	20.5	28.0	4.1	3.5
	AGRI	–	–	5.0	5.0	5.0	5.0	1.0	1.0
	DOC	5.6	5.3	4.3	4.5	4.1	4.2	.8	.8
	NASA	3.2	3.2	2.2	2.0	1.7	1.6	.2	–
	DOD	3.9	3.9	5.1	5.1	5.1	5.0	1.3	1.3
	DOT	2.2	1.4	6.5	4.5	7.0	7.0	1.7	1.7
SUPPORTING R&D		110.1	71.6	213.6	117.0	225.1	166.2	52.3	56.3
Environment:	EPA	30.0	21.0	93.0	40.0	87.0	73.0	19.0	19.0
	NSF	18.9	10.0	26.9	15.0	32.0	19.5	7.0	10.1
	AGRI	–	–	.8	.8	.8	.8	.2	.2
	NASA	.4	.4	.3	.3	.4	.2	.1	–
	DOI	.2	.2	2.6	1.9	6.9	6.7	1.5	1.5
Basic Research:	NSF	60.6	40.0	90.0	59.0	98.0	66.0	24.5	25.5

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11. Combination of Alternatives

In the interest of clarity of presentation, each alternative form of energy has been discussed separately. However, it is likely that each of these alternatives will be developed to a lesser or greater degree, depending on such variables as the direction and pace of technological development, the identification of undiscovered resources, the rate of national economic growth, and changes in lifestyles. The extent to which alternative sources may replace or complement offshore oil and gas is related to the total national energy system. Relevant factors are:

a. Historical relationships indicate that energy requirements will grow at about the same rate as gross national product.

b. Energy requirements can be constrained to some degree through price mechanisms. Other factors such as capital investment may be substituted for energy, for example, insulation for fuel. Lower energy use can be effected through rationing, altered transportation modes, and major changes in lifestyles.

c. Energy sources are not completely interchangeable. Solid fuels cannot be used directly in internal combustion engines, for example. Fuel conversion potentials are limited in the short term and somewhat more flexible in the longer term, when choices in energy-consuming capital goods are made.

d. Research and development effort is being directed to energy conversion - more efficient nuclear reactors, coal gasification and liquefaction, oil shale, and others. Several of these could assume important roles in future energy supply, although their future competitive relationship is still uncertain.

e. Major potentials for filling the supply/demand imbalance are: energy conservation, environmentally acceptable systems using domestic coals, accelerated exploration and development of domestic coals, accelerated exploration and development of domestic oil and gas resources, development of oil shale.

f. Oil and gas imports entail: security risks of relying for essential energy supplies on sources which are politically unstable and which may interrupt supplies to exert political and economic pressure, aggravation of unfavorable international trade and payment balances, high costs of liquefying and transporting natural gas other than by pipeline over land.

C. Delay the Sale

1. Until New Equipment is Available to Provide Increased Environmental Protection

This alternative considers delaying the sale pending the development of new oil spill containment and cleanup equipment. Present equipment is considered adequate for the Gulf of Mexico.

A summary of oil spill containment equipment illustrates the capability limits of existing equipment in cleanup operations under conditions of rough water. Most existing oil spill equipment becomes unusable and inefficient when waves exceed four to six feet in height and in some cases will not hold together when waves exceed eight feet (Leary 1975).

Summary of Equipment:

Modular weir skimmer: In this operation, oil floating on the surface flows by the action of gravity over an edge, into a sump region and into a storage facility. This operation depends on gravity and would seem of very limited value in turbulent waters.

Rotating disc skimmers: The rotating disc skimmer rotates about an axis parallel to the water surface, where it encounters the oil layer, A film of oil clings to the disc surface as it continues its path through the water. A wiper assembly removes the oil. This procedure is susceptable to interference by high waves. An indication of specific wave height is not given although mathematical formulation for estimation is projected.

Oleophilic belt skimmers: This instrument consists of a belt which passes

through the water first, then absorbs the oil as it passes through a slick. The oil is conveyed to a wringing device for recycling.

> "Two or more rotating filter-type belts are installed between the catamaran hulls of the self-propelled skimmer craft. Developed by a large corporation, the belt allows water to flow freely through, but captures and removes the oil and oily debris from the surface of the ocean. It is particularly effective in large waves as the force of the waves enhances the skimming action rather than hinders it." (Smith, 1975).

The above author suggests that in waves above eight feet, the skimmer craft will probably not be used. The force of waves in seas of greater turbulence is enough to disperse oil to such an extent that it is not possible to use mechanical means to retrieve the oil, despite the ability of a skimmer to function with reduced efficiency. However, oil dispersed into the water column as a result creates a toxic hazard to offshore fish.

A series of tests by Leary (1975) on at least three developing methods of high seas oil retrieval gave varied results. The three methods, free vortex, disc drum, and weir basin were required to meet three criteria for high seas testing:

a. To be air transportable in a C-130 aircraft
b. To recover oil at a maximum rate of 2000 gpm.
c. Operate on the high seas in a Sea State 4 with winds of 20 knots and a current of 2 knots. However, the system need not operate in a Sea State 6. 1/

A summary of the results of testing in these three high seas devices follows:

1/ Sea State 6 refers to a severe weather condition with winds of 40 knots.

Weir basin: The weir basin 2000 gpm system (that is weir basin with a recovery goal of 2000 gpm per unit) can be transported by a Coast Guard C-130 aircraft to the point of the spill. The instrument can recover oil of thickness approximately one-half inch when towed at a one knot current speed. Wave heights during laboratory testing measured two foot heights. However, only a reduced model, W-B 1000 gpm is currently able to withstand Sea State 6 environment and recovery is not possible at that time. A W-B 2000 gpm cannot withstand high seas at Sea State 6 at this time.

According to Leary's (1975) testing,

> ". . . with further development, the weir basin system could possibly prove to be a useful device on the high seas especially when towed in a sweeping mode so that a relative current (or two knots) is achieved."

Disc drum: The disc drum is a prototype device which has been subjected to high seas testing on the west coast of the U. S. in the early summer, fall, and winter of 1973 and early 1974. According to Leary (1975), the tests were for the purpose of examining the systems for "structural capability, handleability, seakeeping capability and operational characteristics."

The disc drum was able to recover oil at thicknesses of between on-tenth and one inch with speeds between one-half and three knots and three different oils ranging from 8CS and 1000CS. The disc drum has proven sensitive to viscosity and relative current in terms of recovery rate. The high seas testing very convincingly showed the reliability of operation and superior handleability of the disc drum system(Leary 1975).

Free vortex: The free vortex is still undergoing research and development but it is anticipated as a high seas oil recovery device.

The effects of water motion on spilled oil has been studied by Leibovick (1975). Some comments from his work are cited prior to a discussion on equipment. From his comments, it will be seen that with greater water movement it becomes more difficult and eventually not possible to remove oil despite the strength of operating equipment.

> "Oil spill removal and control in open water is seldom conducted in 'calm' conditions, so the effects of waves and turbulence on the performance of oil spill equipment must be faced . . . . ."
>
> ". . . In addition to wave orbital speed and acceleration effects on skimming action, other effects of waves and water turbulence are:
>
> "The combined action of wave breaking and turbulence can cause floating oil films to disintegrate and become mixed into the water column as droplets. The extent and importance of mixing depends upon oil type and the vigor of turbulence and wave breaking. Once oil is removed from the surface by natural means in large amounts, containment and cleanup operations are pointless.
>
> "Reflections and focusing of short waves is a striking occurrence in containment booms. These effects are analyzed in this paper. Losses due to splash-over can result, and enhanced turbulence in the containment region can occur due to wave breaking. Turbulence can lead, as in the previous item, to loss of oil into the water column. With many oils, the addition of mixing energy due to increased wave breaking has the opposite effect of creating a water-in-oil emulsion. Such emulsions have viscosities that are orders of magnitude greater than that of the oil alone, and this leads to dramatic reduction in the pumping rates of removal and transfer equipment.
>
> "Observations in wave tanks clearly show that oil thickens in wave crests and is thinned out in the troughs. This is a possible mechanism by which oil films may be broken into patches. A theoretical explanation for this phenomenon is given here. One consequence for oil spill containment is that, since there is relatively more oil in wave crests, splash-over losses are larger than would be expected if the oil thickness was nearly uniform . . . . ."

2. Pending Completion of Studies in the Gulf of Mexico Concerning the Potential Environmental Impacts of Offshore Minerals Development

The proposed sale could be delayed for a period of up to one year pending completion of all environmental baseline and other special studies in the Gulf of Mexico proposed sale area. The objectives of the Bureau of Land Management's OCS environmental studies program in the Gulf (see section IV.D.) are as follows:

a. Provide information about the OCS environment that will enable the Department and the Bureau to make better management decisions regarding the development of mineral resources.

b. Basis for predicting impact of oil and gas exploration and development on the marine environment.

c. Establish a basis for prediction of impact of OCS oil and gas activities in frontier areas.

d. Provide impact data that would result in modification of leasing regulations, operating regulations, or operating orders.

The BLM environmental studies effort in the Gulf of Mexico were initiated in May, 1974; with the MAFLA Environmental Baseline Study, and in October 1974 with the South Texas Baseline Study. These studies consist of collecting baseline data for physical and chemical oceanography, geology, plankton, and benthos, and establishing background levels of trace metals and hydrocarbons in sediments, water, and biota.

The MAFLA Baseline Study was completed in March, 1975 and the MAFLA Monitoring Study has been initiated. The first season sampling for the monitoring study was completed in July, 1975.

In the South Texas Baseline Study the third season sampling will be completed in August, 1975, and the subsequent final report will be

available in April, 1976. The monitoring program for South Texas, including site specific monitoring, will be initiated in the latter part of 1975.

In subsequent years, the primary effort of the environmental studies program will be oriented towards baseline and site-specific monitoring. The effort of these programs will be contingent upon the intensity of oil and gas exploration and development activities within the Gulf of Mexico OCS.

This proposed sale could not be held earlier than February, 1976. By February, 1976, the environmental studies program will have been in effect in the Gulf of Mexico for approximately one and one-half years. To delay the proposed sale by one-half to one year would allow for completion of all the baseline information prior to holding a sale.

The information obtained from the completion of these studies prior to holding the proposed sale would provide a greater degree of confidence than presently exists concerning the leasing of any given OCS area and the siting of offshore facilities, including pipelines, in relation to geologic, oceanographic, and biotic parameters. The distribution, numbers, and seasonal variations of species would be useful information not only in the siting of offshore facilities but in determining pipeline routes and burial requirements, and in tract-by-tract evaluations concerning potential environmental impacts from offshore operations. Completion of these studies could provide the necessary information that could prompt deletion of a tract or tracts prior to holding the sale based on unacceptable potential environmental

risk. Presently unknown impacts could be avoided or reduced, but until all studies are completed and analyzed, most impacts can only be speculative.

Information obtained thus far from the environmental studies program has provided information for the formulation of special stipulations and for the additional protection of environmental values within the proposed sale area.

3. Pending Development of Coastal Zone and Growth Plans Onshore

The proposed sale could be delayed pending the development of coastal zone management and growth plans onshore. Delay of the sale awaiting such plans could result in a greater degree of coordinated planning between the State's bordering on the Gulf of Mexico and the federal government.

The Coastal Zone Management Act, by which most states are substantially financing their planning, allows the states three years, or until 1977 (and possibly until 1978), to develop plans.

It is expected that the coastal zone plan will be relatively flexible, tending toward guidelines rather than "locked in concrete," highly specific zoning ordinances. The onshore facilities that directly affect the State's coastal zone are pipelines, support and staging facilities. Support facilities can be and usually are constructed immediately proceeding a sale or when exploratory drilling commences. Pipelines, pipeline terminals, and petroleum storage facilities, and possibly additional support facilities are built after petroleum is discovered, usually one to five years after a lease sale. These facilities are site-oriented and their location will be determined by the companies and approved by relevant state and local governmental authorities.

Finally, it should be noted that until this proposed sale is held, and until oil and gas are discovered, the size or location of needed facilities cannot be specifically identified by industry. It is expected that facility siting will be decided in accordance with applicable State and local regulations, and if in existence, within the framework of a state coastal zone plan.

4. <u>Pending Completed Implementation of Recommendations made in Reports on OCS Operating Orders and Regulations and a Review of Regulations and Amendments as Necessary</u>

A decision could be made to delay this sale until implementation of those recommendations made in reports concerning strengthening operating procedures has been completed. During the implementation of these recommendations, a review could be completed of all operating

and leasing regulations, OCS orders, and statutory provisions to locate sections or areas of needed revision. Any necessary amendments of the regulations and orders could be made through the appropriate procedures and, if sections of the OCS Act were found to need revision, amendments could be suggested to Congress. In considering this alternative, the existing authority of the OCS Act to prescribe and amend regulations any time the Secretary determines it to be necessary and proper so as to provide for the prevention of waste and conservation of the natural resources of the outer continental shelf and the protection of correlative rights therein, must be kept in mind (43 U.S.C. § 1334 (a)(1)). Any revisions of the operating regulations or the OCS orders which relate to the prevention of waste, conservation of natural resources, or protection of correlative rights, could be made at any time and apply to all existing leases.

D. Alternatives Within the Proposed Action

Government Exploratory Drilling Prior to Leasing

Exploratory drilling conducted by or sponsored by the federal government prior to holding a lease sale would be an alternative within the proposed action. This would involve an alternative approach to one aspect of the present federal leasing system. At the present time, there is little exploratory drilling on the OCS prior to leasing. The United States Geological Survey received all engineering and geologic data from companies who have drilled on

leases issued on the OCS. These data and geophysical data purchased on the open market are used by the Geological Survey to develop OCS lease policies and evaluate tracts prior to leasing. For a complete discussion of this alternative see Section VIII.J. of the Final EIS for Proposed Increase on Oil and Gas Leasing in the Outer Continental Shelf.

IX. CONSULTATION AND COORDINATION WITH OTHERS

A. Introduction

This section presents an account of coordination processes involved in the preparation of this draft environmental statement (DES).

B. Preparation of the Draft Environmental Statement

1. Federal Participation

In the preparation of the DES for OCS #41, data and comments were solicited from the following Bureaus and offices within the Department of the Interior:

Geological Survey provided information pertinent to:

- OCS petroleum production for Gulf of Mexico
- Costs estimates for petroleum
- Existing petroleum facilities
- Requirements for OCS operations
- Proposed requirements:pipeline terminal facilities and storage capacity.

National Park Service:

- Southeast Archaeological Center
- Padre Island National Seashore (Review of visual graphic #1)

U. S. Fish and Wildlife Service
Washington Office

- Provided information concerning potential high risk areas (fishing banks)
- Endangered species
- Commercial fishing grounds

Bureau of Mines

- Provided information on the petroleum related economy

In addition the following agencies and Departments were consulted during the preparation phase of this environmental statement:

Environmental Protection Agency

Provided information on the air and water quality
Provided information on ocean dumping

Department of Commerce

National Marine Fisheries Service

Commercial fishing grounds
Fisheries biology
Commercial fisheries catch and landings
Marine biology
Sport fishing
Sediment map data

National Oceanic and Atmospheric Administration

Provided the following information pertinent to the coastal and marine environments:
Marine geology and geophysics
Physical and chemical oceanography
Meterology; hurricane data
Coastal zone environment
Environmental baseline data

Department of Transportation

Provided information on shipping lanes and pipelines

Federal Power Commission

Provided information on the national resources and the probable impact on the economy and environment

Department of the Army

U. S. Army Corps of Engineers - New Orleans

Provided information on assessment of oil and gas production in navigable waterways
Geologic mapping information

2. State Participation

In the preparation of the environmental statement, the following offices, institutions, and associations within the States were contracted for advice and data:

STATE

Louisiana

Office of State Planning
Land use plans, refinery and population data
Wildlife and Fisheries Commission
Wildlife data; commercial fisheries
Gulf States Marine Fisheries Commission (New Orleans)
Fishery data
Louisiana Sea Grant Program
Marine biology
Department of Geology, Louisiana State University
Geographical and geological data pertaining to central gulf
Department of Oceanography, Louisiana State University
Marine geology and biology
Louisiana Geological Survey
Oil and gas map of Louisiana
Geologic map of Louisiana

Mississippi

Mississippi Marine Resources Council
Coastal zone management and fishery data
Mississippi-Alabama Sea Grant Consortium
Fisheries data and sport fishing
Agricultural and Industrial Board
Economy of southern Mississippi
Gulf Coast Research Laboratory
Fishery data and Horn Island data
Mississippi Geological Survey
Upland Soil and geology maps
Gulf Regional Planning Commission
Soils map for coastal Mississippi
Mineral Lease Commission
Leasing plans for state acreage in Mississippi waters
Department of Biology, University of Southern Mississippi
Marine biology data

Alabama

Department of Conservation, Seafoods Division
   Fisheries and marine data
South Alabama Regional Planning Commission
   Land use plans
Alabama Geological Survey
   Geologic maps
Department of Conservation and Natural Resources, Division of Game
   Wildlife data
Alabama Development Office, Coastal Area Board
   Information on coastal zone management planning

Texas

Texas Parks and Wildlife Department
   Wildlife; coastal and offshore fisheries
Comprehensive Planning Branch
   Review of recreation data on visual graphics
Texas Antiquities Commission
   State Historical Preservation Officer
   State Underwater Archaeologist
University of Texas
   Marine Science Institute
   Information on sport fishing research, fisheries biology, marine biology.

Florida

Game and Freshwater Fish Commission
   Wildlife data
Department of Natural Resources - Tallahassee
   Bureau of Beaches and Shores
      Shoreline data
   Bureau of Aquatic Plants
      Vegetation data
   Florida Marine Patrol
      Oil spill and pollution data
   Bureau of Education and Information
      Numerous publications on Florida Coastal Zone
   Coastal Coordinating Council
      Coastal zone management
   Bureau of Marine Science and Technology - Marine Laboratory, St. Petersburg and Tallahassee
      Marine biology, fisheries data and offshore banks
   University of West Florida
      Marine biology and offshore banks
   Department of Pollution Control - Tallahassee
   Bureau of Environmental Programming

Florida (cont'd.)

Air and water quality
Gulf and Caribbean Fisheries Institute - Miami
Fisheries data
SUSIO - St. Petersburg
MAFLA Baseline Study
University of Miami - Miami
Marine biology
Florida Department of State, Division of Archives
History and Records Management
State Underwater Archaeologist
State Historical Preservation Office
Cultural resource information
Department of Natural Resources, Division of Parks and and Recreation
Recreational resource data
Board of Trustees of the Internal Improvement Fund
Information on aquatic preserves and public lands
Florida State University, Florida Resources and Environmental Analysis Center
Recreation resource data
Florida Department of Commerce, Division of Economic Development
Florida Geological Survey, Division of Interior Resources
University of Florida (Gainesville), Bureau of Business Research
Escambia-Santa Rosa Reg. Planning Council, Pensacola
Florida Department of Administration, Division of State Planning
University of Florida, Coastal and Oceanographic Engineering Lab
South Florida Regional Planning Council, Miami
Department of Natural Resources, Division of Coastal Mapping
Tampa Bay Regional Planning Council, Tampa, Florida
Northwest Florida Planning and Advisory Council, Panama City, Florida

3, Industry and Private

Florida Committee on Rare and Endangered Plants and Animals
Endangered species data
Coastal Environments, Inc., Baton Rouge
Geologic and archaeologic data
Aqualife Research - St. Petersburg
Offshore fishing banks
National Audubon Society
Coastal bird species data

C. Coordination and Review of the Draft Environmental Statement Leading to Preparation of the Final Environmental Statement

After the draft statement was prepared, copies were made available to Federal and State governmental agencies and the public. Comments and views were solicited from governmental agencies relative to the draft statement and the proposed action.

In addition, comments and advice were solicited from the public at large, through formal and informal correspondence, and at a Public Hearing held September 23-24, 1975 in Mobile, Alabama.

1. Federal Agencies

The following section contains the comments of Federal agencies from whom review comments of the DES were received. Where appropriate, the disposition of their comments is indicated and any unresolved issues are identified. Remarks of this nature precede the actual presentation of the review agency comments. In this way, we hope that the Departments' responses to many of the issues raised can be easily located and oriented to the agency who brought the issue to our attention.

a. Department of Commerce

The Department of Commerce (Office of Science and Technology) submitted comments concerning a wide range of topics.

Disposition:

These comments were incorporated into the final environmental statement.

1.1 To some extend the discussion of the geological framework is related to exploration for petroleum resources, as this is the major source of geologic data in the Gulf OCS region. A general discussion of the surface environment may be found in section II.A.4 and E.5.

1.2 The potential effects of rigs on the environment are considered in section III.A. 8, D, and G. BLM welcomes any additional information pertaining to site specific effects of rigs on the environment.

1.3 Additional data has been incorporated into section II.A.5. Ongoing baseline studies (Texas and MAFLA) will furnish some additional information pertaining to sediment transport, suspended sediments and rates of reworking of bottom sediments.

1.4 Hydrocarbons and tailings are not expected to concentrate bottom sediments. The increased turbidity during drilling is addressed in section III.C. Insufficient site specific information exists to address the third question.

2.1 The discussion pertaining to coastal sedimentation and pipeline corridors is found in section III.A.4 a, 6, and III.F.

2.2 Additional specific data is being collected on physical oceanography through the Texas and MAFLA baseline studies.

2.3 The effects of oil on plankton are discussed in section III.A.1. The effects of oil on beaches are discussed in section III.F. The long-term effects of hydrocarbons in the marine environment are not well understood (section V.B).

2.4 Both wind and surface current data are used in predicting water mass movements rather than wind data alone (refer to Graphics 6, Volume 3, Surface currents).

2.5 The grammatical, spelling and typographical errors are corrected in the Final Environmental Impact Statement (FEIS).

2.6 Section II.B.2a Sky Cover and Visibility has been corrected.

3.1 It is felt that the term "relatively infrequent" as applied to fog in this region is appropriate. This interpretation was taken from U. S. Department of Commerce. 1967. U. S. Coast Pilot 5, Atlantic Coast, Gulf of Mexico, Puerto Rico and Virgin Islands, 6th edition.

3.2 & 4.1 The suggested additions and correction addressed in these comments have been incorporated into the Final EIS.

4.2 A structure is usually placed at a location where it is most beneficial and economical to develop the mineral resource, in addition, to causing the least amount of interference to a multiple use of the OCS. However, we have considered the mentioned publication and feel that positions from Loran A are inadequate since they vary one mile geographically.

4.3 This comment has been addressed in the first sentence in the section III.A. 8d. Pipelines.

It should be noted that any deep draft ship that traverses a pipeline causing damage will also run aground, no matter what depth the pipeline is buried in the sediment, in such a case, damage would probably be sustained.

4.4 The Bureau of Land Management recognizes the conflict with the commercial fishing industry concerning offshore pipelines. However, at this time, sufficient documentation is not available to demonstrate that unburied pipelines beyond the 200 foot depth represent significant hazards to the commercial fishing industry. It is current policy of this office to require burial of all pipelines within the 200 foot depth and burial of taps and valves at any depth. The Manager of this office maintains the prerogative to require burial at greater depths, if he deems it necessary.

It is appropriate to point out that on February 21, 1975, in a letter to the Regional Director, NMFS, St. Petersburg, Florida, we requested data needed in determining what burial depths are sufficient to prevent damage to trawl hang-ups on pipelines, this data has not been received as of this date.

6.1 & 6.4 These corrections have been incorporated into the Final EIS.

6.5 Tract 30 contains 28 Fathom Bank which has been classified a fishing bank and not a coral reef. The graphic depicts it as having reported coral. However, due to the water depth (150 ft.) and studies of similar type banks by Texas A & M University this

bank is not classified a hermatypic coral reef, i.e., East and West Flower Gardens. In addition, we believe that stipulation c is adequate because of shunting and rig or platform placement in the block.

6.6 After reviewing NOS Nautical Chart 1115A and existing bathymetry maps we found that block 345, Ship Shoal Area, South Addition, and blocks 43 and 44 Main Pass Area do not contain fishing banks. Block 53 Breton Sound Area has been included within stipulation c. In reference to the snapper-grouper banks, stipulation c provides for shunting and rig or platform placement, therefore minimizing the effect of these activities.

7.1 We have contacted and expressed an open door policy to NOAA/NMFS - Division of Environmental Assessment in St. Petersburg; Panama City, Florida and Galveston, Texas, concerning stipulations b and c and stipulations from previous sales. Secretarial Order 2974, Department of the Interior supersedes that narrative in the draft environmental statement.

8.1 The statement referring to factors affecting the public interest according to the Corps of Engineers has been revised and incorporated into the Final EIS.

8.2 & 8.3 These sections have been revised in the Final EIS.

UNITED STATES DEPARTMENT OF COMMERCE
The Assistant Secretary for Science and Technology
Washington, D.C. 20230

October 6, 1975

Mr. Frank A. Edwards
Assistant Director
Minerals Management
Bureau of Land Management
U. S. Department of the Interior
Washington, D. C. 20240

Dear Mr. Edwards:

The draft environmental impact statement "Proposed 1976 Outer Continental Shelf, Oil and Gas General Lease Sale, Gulf of Mexico, OCS Sale No. 41", which accompanied your letter of August 19, 1975, has been received by the Department of Commerce for review and comment. The statement has been reviewed and the following comments are offered for your consideration.

1.1 The discussion of the geological framework sounds like an exploration report, as it deals with the history of the producing beds - not with the surface environment.

1.2 The potential effects of the environment on rigs is covered in a systematic though generalized way. Potential effects of the rigs on the environment are not adequately considered.

1.3 A review of this should at least briefly discuss the natural system of sediment transport (movement of sediments across the bottom); of suspended sediment through the water column; rate of reworking of the bottom; percent of exceeding of threshold velocities on the bottom, etc.

1.4 Other questions not answered are: Will hydrocarbons and tailings concentrate bottom sediments? Will turbidity increase during drilling? Will suspended sediments flux hydrocarbons out of the water column onto the bottom?

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2.

2.1 There is no discussion of the nature of coastal sedimentation and the potential impact of pipeline corridors in this dynamic zone.

2.2 The section on physical oceanography is very weak.

2.3 No consideration of long-term effects; such as formation of tar balls and on their degradation of the environment was given - for example, the tar ball effect on surface plankton, beaches, etc.

2.4 Another problem area is using winddata only for surface currents on the shelf can produce erroneous results. For instance, Mississippi River runoff during 1973 went east and then south rather than northwest as predicted by wind drift.

2.5 There are numerous grammatical and spelling problems in the text. Sometimes the subject disagrees with the verb, as on page 85: "Reference ... are suggested," and, occasionally, there is no verb at all (page 67, lines 12-15). In addition, parentheses used within the text to separate authors and years of publication are often in the wrong positions (page 87, line 3). Also, one of the figures (page 84, Figure 16) cannot be interpreted because of a print problem. Finally, pages 155 to 194 are upside down.

2.6 There are factual problems, as well. On page 60 the text states that cumulus clouds during the warm season build up several hours after sunrise, reach a maximum late morning, and then decrease in intensity. Actually, over the northern Gulf cumulus begin to build around 0300. Land breeze convergence causes showers to reach a maximum in coverage offshore just after sunrise. Sky coverage will then generally decrease by late morning over offshore waters. Another peak in rainfall and cloudiness often occurs along the coast late afternoon due to the expansion of buildups taking place over land areas in the afternoon.

3.

3.1 Page 60, 9th line from the bottom - The formation of Gulf advection fog is caused by warm moist air blowing over chilled water surfaces near the coast, not "land" surfaces. Also, the statement (page 60, 3rd line from the bottom) that fog is "relatively infrequent" at Florida coastal points is not accurate. Panama City, for instance, reports fog 6% of the time during March (see Environmental Guide for the U.S. Gulf Coast, EDS, 1972) These are, furthermore, airport observations and fog is far more frequent closer to the Gulf waters.

3.2 Page 64 - Sometimes during the early morning shower activity waterspouts form within a few miles of the coastline. The statement on page 64 that tornadoes and waterspouts are "extremely rare in this area" is not true. Tornadoes rarely wander far offshore, but they are not terribly infrequent near Gulf coastal areas. See attached tornado frequency map.

3.3 Page 77, line 4 - "counterclockwise" should be changed to "clockwise".

3.4 Page 128, paragraph 1 - The last sentence of this paragraph should be corrected to read "The Mississippi contributes nutrients to most of the estuaries in Louisiana ..."

3.5 Page 212, paragraph 4 - The discussion of big game fishing would be enhanced by also citing and describing the Oceanic Game Fish Investigation 1974 Newsletter, May 1975, Contribution No. 408, Southeast Fisheries Center, NMFS, NOAA, Miami, Florida.

3.6 Page 339 - The crude oil capacities of refineries in the United States and Puerto Rico are respectively 14,220, 316 and 323, 800 barrels per calendar day. The combined refining capacity is, therefore, 14,544,116 barrels per calendar day, not 14,453,116.

3.7 Page 393, Figure 31 - Figure 31, which duplicates the West Flower Garden Area shown in Figure 30, should be replaced to show the East Flower Garden Area, with its proposed restricted zone.

4.1 Page 411, paragraph 2 - The draft environmental impact statement noted that "structures beyond the 240 ft. depth would have a minimal impact on trawling operation." In comments made in 1974 concerning Outer Continental Shelf Lease Sale No. 38 (FES 75-37 page 592, paragraph 3) the National Marine Fisheries Service cited statistics that showed large brown shrimp catches from between 200 and 300 ft. depths off Louisiana and Texas. Further examination shows that the catches were greatest out to about the 270 ft. depth contour. The final environmental impact statement should be revised to indicate that a major impact on trawling operations would likely occur out to 270 ft. deep waters.

4.2 Page 413, paragraph 2 - In discussing underwater obstructions which may cause damage to trawls and nets, the final environmental impact statement should describe and reference the 1975 edition of Bottom Fishing Obstructions: Texas/Louisiana Gulf, by G. L. Graham, (in press) TAMD-SG-76-502, Marine Advisory Service: Fisheries, Texas A&M University. The 1973 issue of this reference identifies the existence (and number) of trawl "hangs" in the following tracts covered by this lease sale 1 (1), 3 (1), 7 (1), 20 (3), 36 (1), 37 (1), 42 (3), 43 (2), 45 (1), 46 (1), 54 (1), 58 (1), and 59 (1). The possibility of locating submerged well heads and/or emergent platforms, resulting from this sale, alongside previously located bottom fishing obstructions so as not to create new "hangs" for shrimp and fish trawls, should be thoroughly discussed and considered for adoption.

4.3 Pages 420-422 - There is no mention in the statement, here or elsewhere, of the hazards to pipelines caused by deep draft ships and anchors. It is suggested that burial requirements for pipelines be examined with respect to these hazards since, by error or emergency, vessels may traverse or anchor outside safe zones.

4.4 Page 421, paragraph 1 - The draft environmental impact statement notes that, "The data necessary for a determin-

ation as to the scope and significance of potential damage to fishing gear resulting from unburied and unmarked pipelines beyond 200 feet in depth has not been forthcoming from the fishing industry or any Government source." In commenting on proposed Outer Continental Shelf Lease Sale No. 38 (FES 75-37, page 592), the National Marine Fisheries Service noted that by 1973 over 5% of the shrimp catches were from waters 210 to 300 feet deep off Texas and Louisiana. The National Marine Fisheries Service also noted that some pipelines were already being buried to the 300 foot contour in the North Sea and that since both the fishing and the oil and gas industries in the Gulf of Mexico are rapidly increasing their activities in waters deeper than 200 feet, any delay in requiring burial in deeper waters will increase the probability of frequent conflict between these two extremely important industries.

Even though few pipelines have already been placed beyond the 200 foot contour, and as the draft environmental impact statement notes, few would be placed as a result of this lease sale, the cumulative effects of all lease sales should be discussed. The present lack of documented hangs on pipelines beyond the 200 foot contour off Texas and Louisiana is not unexpected, since few pipelines have previously been placed out that far. The fishing effort in these depths has only very recently dramatically increased. Also the fishermen are usually unable to confirm whether a "hang" is a pipeline or something else since nothing comes to the surface.

In other parts of the world, problems of fishing gear and anchors hanging on unburied pipelines have been documented. Reports by Brown (1971) and Koster (1975) described the potential danger of anchor damage to buried pipelines and depths of pipeline burial necessary to avoid this conflict. A technique for fluidising firm substrates during pipeline burial was presented by van Steveninck (1975). Gjrsvik, Kjeldsen and Lund (1975) discussed the influence of bottom trawl gear on submarine pipelines. Also de Groot (1975) just recently reviewed the possible effects of beam and

other trawls on submarine pipelines. The final environmental statement should thoroughly discuss these reports in regard to pipeline and damage to both trawls and pipelines and the resulting consequences.

The citation attributed to Snow (1974) is not included in the bibliography. Furthermore, the referenced quotation does not address the topic of whether or not pipeline burial beyond the 200 foot contour would benefit the commercial shrimp industry.

6.1 Page 421, paragraph 2 - The specific industry discussed in the sentence, "Furthermore, industry spokesmen believe ...", should be identified.

6.2 Page 430, paragraph 3 - The specific chemical constituents and how each "will significantly decrease the water quality" should be identified and discussed.

6.3 Page 432 - The maximum oil production is estimated to be 100-300 million barrels of oil, not 100-300 billion barrels of oil.

6.4 Page 433, paragraph 1 - The following sentence should be documented: "Formation waters may contain significant concentrations of toxic material; i.e., cyanide,cadmium, chromium, lead and mercury."

6.5 Page 541, paragraph 3 - In addition to tracts 25, 26 and 29, which contain valuable coral reef habitat, the north half of tract 30 (Block A-392, High Island Area - East Addition - South Extension) contains similar habitat as shown on Visual Graphic No. 4. Therefore, we recommend that the north half of tract 30 be included in stipulation b.

6.6 Page 542, paragraph 5 - In addition to those blocks listed in the draft environmental impact statement as containing fishing banks, block 345 Ship Shoal Area - South Addition, blocks 43 and 44 Main Pass Area, and block 53 Breton Sound Area are also illustrated on Visual Graph No. 4, as

containing fishing banks. NOS Nautical Chart 1116A shows a bank in block 44 Main Pass Area and Block 53 Breton Sound Area. Therefore, these two blocks should be added as containing fishing banks. Visual Graphic No. 4 also portrays parts of fishing banks in block 345 Ship Shoal Area - South Addition and block 43 Main Pass Area. If these are in fishing banks, they should also be listed under stipulations. However, if they are not, the visual graphic should be corrected.

We further recommend that the final environmental impact statement discuss the advisability of applying stipulations to block 374 Brazos Area, the south half of block A-392 High Island Area - East Addition - South Extension, Block 242 South Marsh Island Area - North Addition, block 390 Eugene Island Area - South Addition block 345 Ship Shoal Area South Addition and block N641E131 New Orleans South No. 1, which contain frequently fished snapper-grouper banks of limited area. The additional stipulations would be that (1) drilling and construction of production structures within these tracts be conducted between November 1 and June 1, the period of minimum sport fishing. If drilling under such fishing banks is necessary during the summer or early fall, directional drilling from adjacent locations should be employed, (2) permanent platform not be constructed on the top of slopes of any small, abruptly rising snapper-grouper banks if such structures reduce the accessibility of the bank of fishermen, and (3) no drill cuttings, drilling muds and garbage, or debris be discharged onto snapper-grouper banks.

7.1 Page 543, paragraph 5 - Concerning stipulations b and c, NOAA/NMFS, along with BLM and FWS, should be afforded the opportunity to submit recommendations for protective measures. Under Reorganization Plan No. 4 of 1970 (35 F.R. 15627, 84 Stat. 2090) and related laws, NOAA is vested with a major responsibility for, among other things, participation in matters relating to the marine and estuarine areas. With respect to fisheries, the NOAA responsibility is carried out by NMFS.

.1 <u>Page 551, paragraph 1</u> - In their public notices, the Corps of Engineers has been stating that the decision as to whether a Department of the Army permit is granted for the installation of islands, fixed structures and the drilling of wells from mobile drilling vessels on the Outer Continental Shelf would be based on an evaluation by the Corps of the impact of the proposed work on navigation and national security only. In this regard, the Corps of Engineers' public notices note that environmental aspects have already been considered in the environmental impact statement prepared by the Bureau of Land Management. However, this draft environmental impact statement paragraph notes that "factors affecting the public interest according to the Corps of Engineers include, but are not limited to, navigation, fish and wildlife, water quality, and economics ..." This statement represents a departure from previous Corps of Engineers policy on the Outer Continental Shelf. This apparent change should be thoroughly clarified in the environmental impact statement.

.2 <u>Page 554, paragraph 3</u> - In regard to temporary increases in turbidity levels resulting from the discharge of drilling muds and cuttings, and the excavation of pipeline trenches by jetting and dredging, it is noted that "The duration of the impact in a given area will be no longer than a few hours, but if it occurs in shellfish beds and similar concentrations of organisms, the impact would be considered significant." The duration of the impact as well as a description of what would be "considered significant" should be documented.

.3 <u>Page 556, paragraph 3</u> - The last sentence of this paragraph would be more accurate if it were altered to read "However, if any of these beaches are contaminated by oil, and undetermined amount of fish and wildlife (primarily birds) will be damaged."

Thank you for giving us an opportunity to provide these comments, which we hope will be of assistance to you. We

would appreciate receiving fifteen copies of the final statement. We also request one copy of the final statement be sent to Area Supervisor, Environmental Assessment Division, NMFS Center, 4700 Avenue U, Galveston, Texas 77550.

Sincerely,

Sidney R. Galler

Sidney R. Galler
Deputy Assistant Secretary
for Environmental Affairs

Enclosures

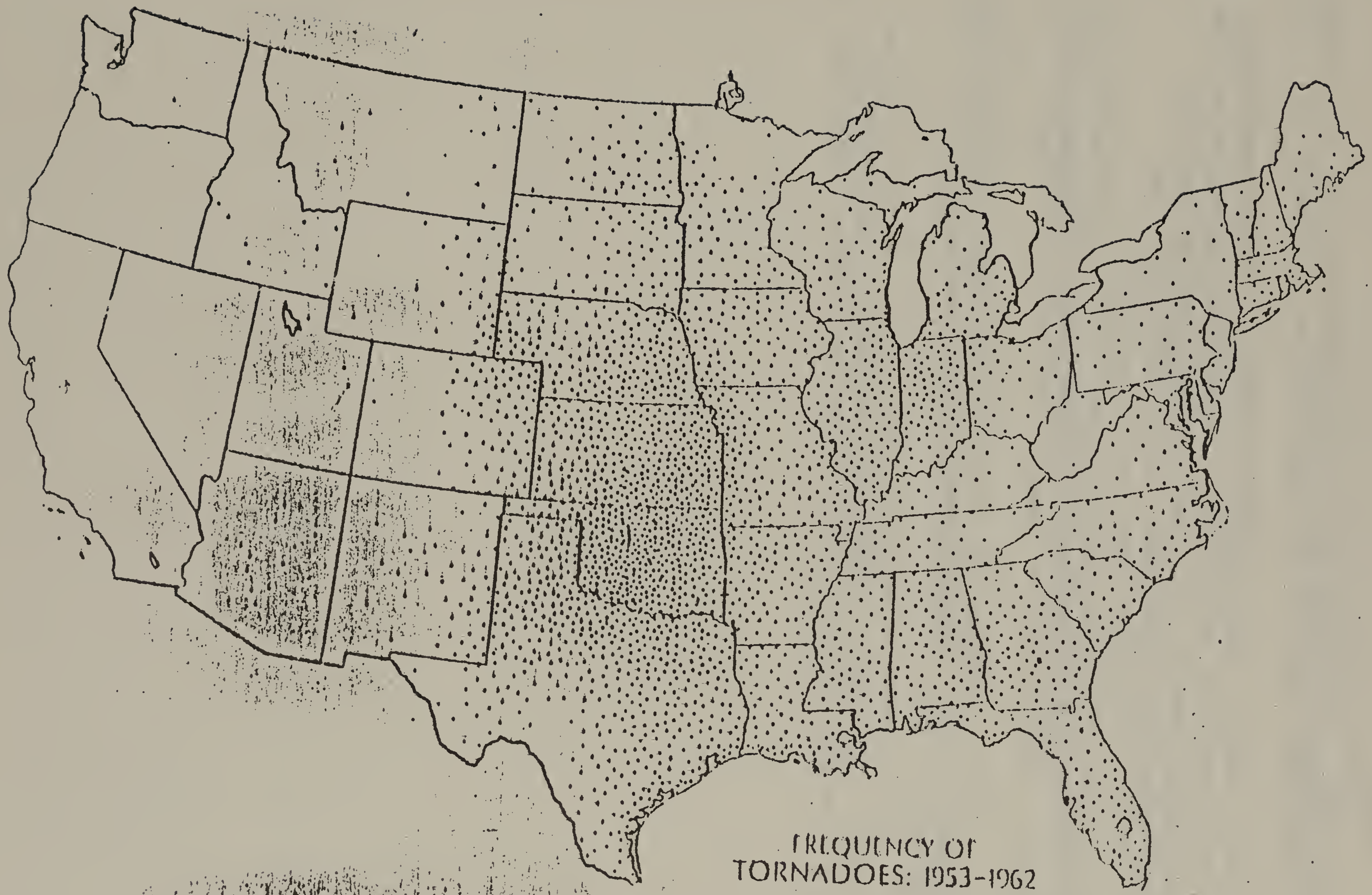

FIGURE 2.5-2. FREQUENCY OF TORNADOES, 1953-1962. EACH DOT REPRESENTS THE APPROXIMATE LOCATION OF TWO OCCURRENCES DURING THE TEN-YEAR PERIOD. SOURCE: U.S. GEOLOGICAL SURVEY, *NATIONAL ATLAS OF THE UNITED STATES OF AMERICA*, U.S. DEPARTMENT OF THE INTERIOR, 1970.

Literature Cited:

Brown, E.J., 1971. How deep should an offshore line be buried for protection? The Oil and Gas Journal, October 11, 1971.

de Groot, S.J., 1975. The possible effects of beam and otter trawls on submarine pipelines. Preprint presented at the International Council for the Exploration of the Sea. Cost and Behavior Committee. C.M. 1975/B:4. sp.

Gjørsvik, O., S.P. Kjeldsen and S. Lund, 1975. Influences of bottom trawl gear on submarine pipelines. Offshore Technology Conference, Dallas, Texas, paper No. OFC 2280, 9p.

Koster, J., 1975. Dutch crab anchor literature to avert pipeline threat. Int. Dredging and Port Construction, Ser. II (10):25-27.

van Steveninck, J., 1975. Pipeline burial by fluidization. Offshore Technology Conference, Dallas, Texas, paper No. 2276 2p.

a. Department of Commerce

(1) National Marine Fisheries Service

NMFS/NOAA, Department of Commerce submitted comments pertaining to several topics.

Disposition:

These comments were incorporated into the preceding correspondence from The Department of Commerce, Office of Science and Technology.

The appropriate revisions have been made in the Final EIS or an explanation is given in the responses to the preceding comments.

U.S. DEPARTMENT OF COMMERCE
National Oceanic and Atmospheric Administration
NATIONAL MARINE FISHERIES SERVICE
Duval Building
9450 Gandy Boulevard
St. Petersburg, FL 33702

September 30, 1975

FSE21/DM

Office of the Manager
Gulf of Mexico Outer Continental Shelf Office
Bureau of Land Management
Suite 3200, The Plaza Tower
1001 Howard Avenue
New Orleans, LA 70113

Dear Sir:

In a notice of public hearing, the Bureau of Land Management requested views, comments and suggestions regarding the possible oil and gas lease sale of 135 tracts of submerged lands on the Outer Continental Shelf, in the Gulf of Mexico.

This report is submitted by the National Marine Fisheries Service (NMFS) of the National Oceanic and Atmospheric Administration under authority of Reorganization Plan No. 4 of 1970 (35 Fed. Reg. 15267. 84 Stat. 2090) and in accordance with the provisions of the Fish and Wildlife Coordination Act (48 Stat. 401, as amended; 16 U.S.C. 661 et. seq.). Comments on the Draft Environmental Impact Statement are being prepared by the NMFS for inclusion in the report to be submitted from the Office of the Assistant Secretary of Commerce under provisions of the National Environmental Policy Act of 1969 (PL 91-190, 83 Stat. 852).

Our primary interest in exploration and development of oil and gas resources on the Outer Continental Shelf of the Gulf of Mexico is to insure that the operations create as little adverse impact as feasible on the Gulf's valuable marine fisheries and habitat. An example of the Gulf's valuable fishery resources is reflected in the commercial catch, which in 1974 was over 1.5 billion pounds of fish and shellfish valued greater than $240 million to the fishermen.[1/] This harvest included over 70 million pounds of shrimp worth nearly $95 million (dockside) taken from waters of Louisiana and Texas and the adjoining Continental Shelf.[2/] Also, it is estimated that 872 thousand saltwater anglers caught 97 million fish weighing 152 million pounds in the western Gulf of Mexico.[3/] Half of these were taken in open Gulf water. Studies of big game fishing reported extensive sportfish catches of billfish in the northern Gulf.[4/][5/]

In our letter of February 12, 1975, to the Director, Bureau of Land Management, regarding OCS Lease Sale No. 38 (FES 75-37, page 592), we noted that in just 3 years (1971-1973) the percentage of shrimp catches from waters 210 to 300 feet deep off Texas and Louisiana, rose from less than 1% to over 5%. We also noted, that some pipelines were already being buried to the 300-foot contour in the North Sea. Since both the fishing and the oil and gas industries in the Gulf of Mexico are rapidly increasing their activities in waters deeper than 200 feet, any delay in requiring burial in deeper waters would increase the probability of frequent conflict between these two important industries. The cumulative effects on the fishing industry would likely be great. Therefore, in the interest of the commercial fishing industry pipelines should be buried out to the 300-foot contour where feasible. Furthermore, a recent report indicated that pipelines can be buried by a fluidization method that creates a much greater immediate coverage of the pipe by bottom sediment than the coverage secured by jetting.[6]

An examination of your Visual Graphic No. 4 for Texas and Louisiana in Volume 3 of the Draft Environmental Statement for OCS Sale No. 41 and the National Ocean Survey Navigation Charts C+CS 1115A, 1116A and 1117A, indicates that many of the tracts proposed for leasing contain excellent marine fisheries habitat. Tracts containing fishing banks, coral banks, etc., are extensively used by sport and commercial fishermen. We, therefore, offer the following recommendations:

1. Exploration and production operations should be conducted only with rigid adherence to regulations and other procedures designed to minimize the likelihood of oil spills.

2. All debris dropped on the seafloor that may foul sport or commercial fishing gear should be removed as soon as possible.

3. All well heads protruding above the seafloor should be marked by a lighted platform or a frequently-maintained lighted buoy to prevent fouling of fishing gear. Whenever possible, well heads should be terminated beneath the seafloor.

4. All pipelines placed in waters less than 300 feet in depth should be buried beneath the seafloor. In deeper waters where burial is not technically feasible, pipelines should be marked by lighted buoys and/or lighted ranges on platforms until the pipeline no longer protrudes above the seafloor. Also, whenever feasible, pipelines should be buried by a method such as fluidization that provides the maximum immediate pipeline coverage with sediments.

5. Pipelines should be located to enter the coastline where the least amount of fishery habitat will be traversed.

6. Whenever possible, protruding well heads and/or emergent platforms should be installed alongside existing bottom fishing obstructions to preclude creating new "hangs" for shrimp and fish trawls.

The 1973 issue of Bottom Fishing Obstructions: Texas/Louisiana Gulf by G. L. Graham, Marine Advisory Service; Fisheries, Texas A&M University, identifies the existence and number of trawl "hangs" in the following tracts covered by this lease sale:

TRACT	BLOCK	AREA	NUMBER OF HANGS
1	741	Mustang Island	1
3	600	Matagorda Island	1
7	374	Brazos	1
20	A-280	High Island-East Addition-South Extension	3
36	342	West Cameron-West Addition	1
37	583	West Cameron-South Addition	1
42	219	East Cameron	3
43	220	East Cameron	2
45	234	East Cameron	1
46	235	East Cameron	1
54	124	South Marsh Island-South Addition	1
58	289	Eugene Island-South Addition	1
59	337	Eugene Island-South Addition	1

(A 1975 edition of G. L. Graham's paper is now in press and will be referenced TAMU-SG-76-502).

7. Any drilling and construction of production structures on frequently fished snapper-grouper banks should take place only between November 1 and June 1, the period when the least amount of sport fishing takes place. If drilling is necessary under such banks in the summer or early fall, directional drilling from an adjacent location should be employed. Permanent platforms should not be constructed on the top or slopes of any small, abruptly rising snapper-grouper banks if such structure would reduce the accessibility of the reef to the fishermen.

Following is a list of numerous proposed tracts which apparently contain significant marine fisheries habitat. (NOTE: from Volume 3, DES, OCS Sale No. 41, the meaning of "Group of Banks," would be the same as Fishing Banks.)

TRACT	BLOCK	AREA	HABITAT
7	374	Brazos	Fishing Bank
25	A-374	High Island-East Addition South Extension	Coral Bank
26	A-375	" "	" "
29	A-384	" "	" "
30	A-392	" "	Fishing & Coral Bank
35	226	West Cameron	Group of Banks
37	583	" " -South Addition	Fishing Bank
47	246	East " " "	" "
53	352	Vermilion-South Addition	" "
56	242	South Marsh Island-North Addition	" "
63	390	Eugene Island-South Addition	" "
64	345	Ship Shoal-South Addition	" "
69	43,44	Main Pass	" "
71	53	Breton Sound	" "
72	N641E131	New Orleans South No. 1	" "

We appreciate the opportunity to submit this report and will be available for further consultation with the Bureau of Land Management at the field level throughout the implementation of this lease sale.

Sincerely,

for William H. Stevenson
Regional Director

Enclosure
Literature Cited

Literature Cited

1/ Anon., 1975. Fisheries of the United States, 1974. Current Fishery Statistics No. 6700. 98p.

2/ Anon., 1975. Gulf Coast Shrimp Data, Annual Summary 1974. Current Fisheries Statistics No. 6725. 33p.

3/ Deuel, D. G. 1973. 1970 Salt-Water Angling Survey. Current Fishery Statistics No. 6200. 54p.

4/ Anon. 1975. Oceanic Game Fish Investigations, 1974 Newsletter, Contribution No. 408, Southeast Fisheries Center, NMFS, NOAA, Miami, Fla. 20p.

5/ Rivas, L.R. 1974. Big Game Fishing in the Northern Gulf of Mexico during 1973. NMFS, Panama City, Fla 6p. 18 tables, 2 figures, 12 charts.

6/ van Steveninck, J., 1975. Pipeline burial by fluidization. offshore technology conference, Dallas, Texas, paper no. 2276, 2p.

a. Department of Commerce

(2) Office of Energy Programs

The Office of Energy Programs , Department of Commerce, submitted comments pertaining to potential production figures and income from recreation and tourism in Florida.

Disposition:

The comments were incorporated into the Final Environmental Impact Statement.

1.1 The estimated number of platforms (20-50), wells (150-400) and oil production (35,000-120,000 barrels/day) are based to some extent on the amount of acreage that may be leased as a result of the sale.

The estimated production from the leases is based on a stabilized production rate, and part of the production presently recorded from the Gulf of Mexico OCS is obtained from leases which have been producing lower amounts due to natural decline.

Exploration to date in the Florida OCS area has not been successful, and the production estimated to result from this sale may be obtained from leases awarded off the coasts of other states.

2.1 Information pertaining to income from recreation and tourism has been added to section II.I.1b.

UNITED STATES DEPARTMENT OF COMMERCE
The Assistant Secretary for Science and Technology
Washington, D.C. 20230

October 29, 1975

Mr. Frank A. Edwards
Assistant Director
Minerals Management
Bureau of Land Management
U.S. Department of Interior
Washington, D.C. 20240

Dear Mr. Edwards:

Reference your draft environmental impact statement entitled, "Proposed 1976 Outer Continental Shelf, Oil and Gas General Lease Sale, Gulf of Mexico, OCS Sale No. 41." Although the enclosed comments were received after our letter to you of October 6, 1975, we are forwarding these comments to your attention with the hope that they will be considered in the preparation of the final environmental impact statement.

Thank you for giving us an opportunity to provide these comments which we hope will be of assistance to you. As we indicated in our letter, we would appreciate receiving fifteen (15) copies of the final statement.

Sincerely,

Sidney R. Galler

Sidney R. Galler
Deputy Assistant Secretary
for Environmental Affairs

Enclosure

American Revolution Bicentennial 1776-1976

UNITED STATES DEPARTMENT OF COMMERCE
Office of the Secretary
Washington, D.C. 20230

October 29, 1975

MEMORANDUM FOR: Sidney R. Galler
Deputy Assistant Secretary for
Environmental Affairs

SUBJECT: Comment on Draft Environmental Statement for OCS Sale Number 41 in the Gulf of Mexico

The Office of Energy Programs has reviewed the draft environmental impact statement for proposed OCS sale number 41. We have concluded that the draft statement is methodologically sound, thorough, and generally well conceived. Data in the draft statement and the manner in which they are presented amply support the conclusion that the proposed lease sale, although it does carry some potential environmental risk, would not add substantially to the environmental impact of petroleum exploration and production already in progress in the Gulf of Mexico. Another persuasive point made in the draft statement is that crude oil that might eventually result from OCS sale number 41 would take up current slack in the area's refinery capacity and thus reduce the rate of crude import growth. Rapid import growth would carry with it the environmentally more significant risk exposure associated with increased tanker traffic in the Gulf.

1 One question we have about the draft statement is its estimate of potential production from tracts in the proposed lease sale. It estimates potential lease area production at 35,000 to 120,000 barrels of oil per day and 0.5 to 1.1 billion cubic feet of gas per day (pages 464-465). Since current production of oil in the Gulf is about 850,000 barrels per day from something over 2000 wells, this potential increase of up to 14 percent from only 20 to 50 additional wells seems high. In our view, the disappointing results of recent exploration in the Destin Anticline off the northwest coast of Florida raises questions with respect to the probability of finding highly productive deposits in the proposed lease areas.

2.1 We should also like to note that the statement does not provide an estimate of income from recreation and tourism, an economic sector to which the statement attaches great importance and which might sustain serious losses in the event of a major oil spill. The statement should have provided a dollar value estimate of income from this sector just as it has for agriculture, forestry, fisheries, mining, manufacturing and government. Such an estimate would have given a more meaningful perspective on the potential economic losses in the region which might result from a major pollution event.

On the positive side we were particularly impressed with the quality of the graphic presentations and the thorough, detailed inventory of economic, cultural, historic, scenic and wildlife resources in the impacted area. The completeness of these data reflects the maturity of the area's economic, governmental and educational institutions which provided much of the data in the statement.

Samuel J. Tuthill
Director
Office of Energy Programs

b. Department of Defense

The Department of Defense submitted comments pertaining to Defense Warning Areas, Matagorda Island, and ordnance disposal.

Disposition:

These comments have been incorporated into the Final Environmental Impact Statement.

1.1 BLM will consider including the recommendations of DoD, pertaining to lease tracts located with W-151 and W-470; within either the notice of sale or lease agreements, if a decision is made to hold the proposed sale.

2.1 The information pertaining to Matagorda Island has been incorporated into section II.G.2b.

2.3 The information relating to ordnance disposal in section III.E. has been revised to reflect DoD policy.

ASSISTANT SECRETARY OF DEFENSE
WASHINGTON, D. C. 20301

HEALTH AND
ENVIRONMENT

23 OCT 1975

Manager
Gulf Outer Continental Shelf Office
Plaza Tower, Suite 3200
1001 Howard Avenue
New Orleans, Louisiana 70113

Dear Sir:

This is provided in response to your request of August 19, 1975 for our comments on the draft environmental impact statement pertaining to the proposed 1976 outer continental shelf oil and gas general lease sale in the Gulf of Mexico (OCS Sale #41). The proposed action will primarily impact the Department of Air Force activities. Specific comments on the potential impact on Air Force operations in the proposed lease sale area, along with other comments pertaining to Matagorda Island, are contained in the enclosure.

Thank you for the opportunity to review the draft statement.

Sincerely,

for George Marienthal
Deputy Assistant Secretary of Defense
(Environmental Quality)

Enclosure

AMERICAN REVOLUTION BICENTENNIAL 1776-1976

COMMENTS ON THE DRAFT ENVIRONMENTAL IMPACT STATEMENT ON THE PROPOSED 1976 OUTER CONTINENTAL SHELF OIL AND GAS GENERAL LEASE SALE, GULF OF MEXICO (OCS SALE NO. 41).

The greatest potential impact on the Air Force is from the proposed lease of the tracts roughly bounded by 28°50' to 29° 10' N and 84°40' W. These proposed tracts lie within a Defense Warning Area known as W-470. Both training and research and development programs involving firing of missiles and rockets are conducted in this area. These programs are monitored via fixed instrumentation sites located at Cape San Blas and Carrabelle, Florida. The continuation of these operations is considered highly essential and any restrictions on full use of this area could have an adverse impact on the AF training and test programs. It is strongly recommended that further oil or gas lease sales not be conducted in this area.

Similar, but slightly less serious, impacts will result from the five proposed lease tracts roughly bounded by 29°30' to 29°45' N and 85°55' to 86°10' W. These proposed tracts lie within Defense Warning Area W-151 and constitute a southerly extension of existing oil/gas leases. Any extension of the existing area could seriously impact AF operations and it is therefore recommended that these tracts be deleted from those available for lease. If, however, this is not possible it is recommended that the following general stipulations be included in the Commerce Daily Announcement, the invitation for bid, the lease agreements and any other appropriate documents. (Reference: Federal Register, Vol 38, #222, 19 Nov 1973).

a. The lessee must control his electromagnetic emissions to prevent interference with DoD operations in the area.

b. All boat and aircraft traffic generated by the lessee must be under positive control at all times to prevent interference with DoD activities.

c. The lessee must agree to evacuate all personnel upon notification by the DoD of activities which may endanger personnel or property.

d. The lessee must agree to hold the U.S. harmless for all loss, damage or injury sustained by the lessee or his employees.

e. The lessee must also enter into an agreement with the AF range controller to cover all of the above stipulations.

The 26 proposed tracts located in Defense Warning Area W-168 and roughly bounded by 27°10' to 27°40' N and 83°45' to 84°20' W could be subject to sonic booms and ground level hazards associated with air-to-air gunnery using live 20 mm ammunition. Similar stipulations to those listed above should be included in the necessary documents.

On page 189 of Volume 1 of the Draft Environmental Impact Statement it states that "The Department of Defense administers approximately 35,563 acres on Matagorda Island as the Matagorda Air Force Range which it uses for a variety of military and non-military purposes." This should be corrected to reflect the current status as outlined below.

The Air Force owns or leases approximately 50,000 acres on Matagorda Island which were used for a variety of military purposes. All of this property has been determined to be excess to the requirements of the DoD. Disposal of this property has been cleared with the Congressional Armed Services Committees and a Report of Excess is being prepared for forwarding to the GSA. All military uses of this property ceased as of 30 June 1975. Action is currently underway to clear the property of unexploded ordnance and ordnance residue.

On page 439 of Volume 2 of the Draft Environmental Impact Statement, the statement is made that "Continued use of shallow, nearshore portions of the continental shelf for ordnance disposal prohibits full exercise of the multiple use concept common to natural resource management programs." This statement should be expanded to make it very clear that it is not DoD policy to dispose of ordnance in shallow waters. Such disposal is only carried out in an extreme emergency and only when necessary for the preservation of life or saving of an aircraft and never as a routine disposal procedure.

c. Department of Interior

(1) Bureau of Mines

The Bureau of Mines submitted comments pertaining to land subsidence, productivity and visual graphics.

Disposition

Most of the comments from the Bureau of Mines were incorporated into the Final EIS. The following are either exceptions or require explantion.

1.1 Fluctuation of sea level must be studied jointly with elevation changes on land as referenced to Turner et al. (1966) for the Houston-Galveston area. NOAA's National Ocean Survey tide gage and leveling projects have offered long term precision to these studies. Mr. Stacy Hicks (NOAA-NOS) has studied sea level fluctuations and probable causes and he can be contacted along with other experts on this subject at NOAA's office in Rockville, Maryland. Figure 6 shows fluctuations of several meters in the past 2000 years with a presumption on the gross scale of 100 meters, that sea level changes are diminishing in the past 6,000 years.

1.2 Temporal extension of the utilization of a non-renewable resource will increase net yield as utilization becomes more efficient. The long-term productivity of renewable resources could be diminished if the producing systems are overly stressed.

2.1 In reply to any inconsistency i.e., symbols, color, type, etc.,

we agree that this does exist. However, this problem has been corrected for the Final using the eastern Gulf visual graphics as the format.

3.1 The three-league line is in blue consistently on the Final.

3.2 Visual number four will read "Undersea Features" for the Final. The blank spots are cartographic errors and have been corrected for the final.

3.3 On Visual number six the "Ocelot and Jaguarundi" line will remain the same with the exception the line will have arrows pointing in for location.

3.4 The title for Visual number one on the Final will read "Lease Status/Recreation/Historical and Archaeological Resources". The lack of color is a cartographic error, the final has the corrections made.

3.5 The uncolored and unpatterned errors are cartographic errors. They have been corrected for the Final. The same for visual number three.

3.6 The Red Wolf and the Mississippi Sand Hill Crane symbol have been changed for the Final. The dabbling duck and furbearers habitat has been completely changed for the Final. The spelling of Mississippi has been corrected.

4.1 These are visual drawings at a scale of approximately 1:1,000,000 (as identified) and for this reason a bar scale would tend to have these visuals cartographically perfect. A graphic scale as identified on each visual alleviates the problem. The 3000 meter line is identified on the Final.

4.2 The Final visuals for archaeological sites are identified :number of reported archaeological sites per county". We estimate that at least 95% of the shipwrecks on visual number four are sunken ships of no archaeological value. The word "monuments" has been corrected for the Final.

4.3 The legend on visual number three will be changed to represent a breakdown of upland soils and bottom sediments for the Fina. The "Truncate" line delineates the eastern boundary of the area included in this environmental impact statement. This area will be included in the South Atlantic visuals for proposed lease sale 43. The uncolored area is a cartographic error - correction has been made for Final. The lack of longitude and latitude numbers were inadvertenly left off by the printer and will be corrected for the Final.

4.4 The legend identifies the color of the "Principal inshore harvest and estuarine nursery boundaries". The type size for shrimp catch in the legend is the same as used on the visual for the Final. The type is in different locations for cartographic reasons.

4.5 - 4.8 These visuals have been totally re-worked for the Final. All suggestions made have been incorported into the new visuals.

OFFICE OF THE DIRECTOR

United States Department of the Interior

BUREAU OF MINES
2401 E STREET, NW.
WASHINGTON, D.C. 20241

RECEIVED

October 14, 1975

DES 75-48

Memorandum

To: Manager, Bureau of Land Management, Outer Continental Shelf Office, New Orleans, Louisiana

Through: Assistant Secretary--Energy and Minerals Rolland R. Reid
OCT 24 1975

From: Director, Bureau of Mines

Subject: Draft environmental statement, Bureau of Land Management, Proposed 1976 Outer Continental Shelf Oil and Gas General Lease Sale, Gulf of Mexico (OCS Sale No. 41)

The Bureau of Mines Eastern Field Operation Center, Pittsburgh, and the Intermountain Field Operation Center, Denver, have reviewed the draft environmental statement concerning a proposed oil and gas lease sale in the Gulf of Mexico, prepared by the Bureau of Land Management. The sale under consideration includes 135 tracts offshore Texas, Louisiana, Mississippi, Alabama, and Florida. The total area of the proposed sale would be 698,077 acres, which would constitute an increase of about 9.3 percent of the current total of 7.5 million acres (as of March 1975) under Federal lease in the Gulf of Mexico.

1.1 The discussion of land subsidence on pages 32 and 34 attributes it to rising sea levels. This assertion is not documented in the report and it contradicts Figure 6 (page 45) which concludes, "Sea level has remained relatively constant for the past 6,000 years and the amplitude of short-term oscillations is diminishing." Moreover, part of the statement on page 32, "Causes of the rise in sea level are generally attributed to the melting of glaciers and polar icecaps and the pumping of water from subterranean aquifers which water eventually drains into the sea," is undocumented. References that document the rising sea level should be cited in the report as should articles which have "generally attributed" such rise to "pumping of water from subterranean aquifers."

1.2 The discussion of local short-term use and long-term productivity on page 565 contains the statement, "This mineral extraction will contribute to the diminishment of the long-term productivity of the oil and gas resources of the Gulf of Mexico and possibly marine and coastal resources." The reasoning

AMERICAN REVOLUTION BICENTENNIAL 1776-1976

behind this statement, from the practical viewpoint of needed production, does not seem to track and leaves the impression that long-term productivity will permit greater yield. The point not mentioned is that these resources, if not tapped, have no value in place and can only be of benefit if they can be utilized, especially in the present supply situation. Short-term use of the land is not equatable to long-term productivity. Also, oil and gas production would be for only a minimal length of time when compared to the long-term production of other renewable resources of the gulf.

2.1 This three-volume draft statement appears to be fairly comprehensive; however, it is riddled with minor typographical, grammatical, and other errors. For example, duplicate pages 536 through 565 inclusive were bound into our copy of Volume 2 between pages 565 and 566. The need for review and correction is particularly apparent in the 25 multicolored maps (Visual Graphics) which comprise Volume 3 of the report. These maps represent an essential and costly portion of the environmental statement. As such, they should be clear, concise, consistent, and correct; yet the map titles do not always agree with the titles on pages v and vi of Volume 1, and the titles and symbols of the Western Gulf series are not consistent with corresponding maps of the Central Gulf or Eastern Gulf series. The legends should, at least, be consistent as to ink color, type size, and format. A partial list of other noted deficiencies is appended to these review comments.

Thomas V. Falkie
Director

Attachment

SPECIFIC DEFICIENCIES OBSERVED IN VOLUME 3, VISUAL GRAPHICS

Western Gulf of Mexico

3.1 All maps of this series label the three-league line "3 League Line" in blue ink; the Central Gulf series leaves the line unlabeled, and the Eastern Gulf series of maps labels the line "Three League Line" in black ink. Consistency among the three sets of maps is lacking.

3.2 Visual Graphic 4 should read "Undersea" instead of "Under Sea: in the title. This map also contains a number of uncolored areas bounded with red or blue lines near the Flower Garden banks and for which there is no explanation.

3.3 Visual Graphic 6 denotes the habitat of the ocelot and jaguarundi with a single unclosed red line. There is no indication which side of the line represents ocelot and/or jaguarundi habitat. Or is it to be assumed that the red line is a migration pattern or that they may be found as far north as Kenedy County, Texas?

Central Gulf of Mexico

3.4 Visual Graphic 1 shows oil and gas tract lease status, yet the title suggests this is a map of historic resource lease status. Colored overprinting has been omitted from the outlined Gulf Islands National Seashore.

3.5 Visual Graphic 2 displays a number of uncolored and unpatterned areas across the map which are not explained. A similar uncolored and unexplained area appears along the coast of Terrebonne Parish, Louisiana, and east of Mobile Bay, Alabama, in Visual Graphic 3.

3.6 Visual Graphic 6 shows environment of the red wolf and the Mississippi sandhill crane in different line widths on the map than in the legend. Moreover, a habitat symbol of the primary dabbling duck and furbearers habitat is confusing; a simple bracket encompassing the fresh, intermediate, and brackish marshes symbols to the left of the habitat column in the legend would appear less ambiguous. No sea turtle nesting areas are identified on the map although a stipple pattern for this habitat is included in the legend. Mississippi is misspelled in the explanation of alligator distribution.

Eastern Gulf of Mexico

4.1 No bar scales or numerical scales are shown on the Eastern Gulf of Mexico series of maps. In addition, the 3,000-meter contour is unlabeled on all maps in this series.

4.2 Visual Graphic 1 indicates by its title that archaeological sites are shown on the map, but only the total number of reported sites per county are shown on the map. Archaeological sites such as shipwrecks are shown in Visual Graphic 4 although the title contains no reference to these sites. "Monuments" is misspelled in the legend, and the added note indicating numbers keyed to the back of the map is situated below the reference to the total number of reported archaeological sites per county. The note properly refers to sequential numbers placed beside symbols for national register historic sites and should be relocated to eliminate confusion.

4.3 Visual Graphic 3 contains no titles in the legend to distinguish between upland soils and bottom sediments. A red line bisects the Florida peninsula and truncates upland soil information without explanation. (A similar unexplained and unlabeled red line in a slightly different location also appears in Visual Graphic 4.) An area southwest of Lee and Collier Counties, Florida, has been left uncolored; in addition, all latitide and longitude identifiers and contour labels have been omitted.

4.4 Visual Graphic 5 shows principal inshore harvest boundaries as a line on the map, but as a solid color in the legend. Red snapper catch is illustrated below the fishing zone grid number in the legend; however, the number appears above the zone number on the map. Moreover, the shrimp catch is shown in different sizes of type and in different locations on the map and in the legend.

General Gulf of Mexico maps

4.5 This series of maps contains no bar scale and maps 1 and 2 do not even list a numerical scale.

4.6 Visual Graphics 2, 3, 4, and 5 show latitude and longitude grid lines but fail to label them.

4.7 Visual Graphic 4 contains a misspelling of "Clupeids" in the legend and uses an identical colored stipple pattern to identify little tuna, blackfin tuna, and skipjack resources.

4.8 Visual Graphic 5 shows hatchure patterns off the west coast of Florida which is not labeled or explained in the legend. Green-, yellow-, and violet-colored areas with arrows also are unexplained in the legend.

c. <u>Department of the Interior</u>

(2) <u>Bureau of Outdoor Recreation</u>

The Bureau of Outdoor Recreation stated the impacts related to outdoor recreation had been adequately addressed in the Draft Environmental Impact Statement.

United States Department of the Interior
BUREAU OF OUTDOOR RECREATION

SOUTH CENTRAL REGIONAL OFFICE
PATIO PLAZA, 5000 MARBLE N.E., ROOM 211
ALBUQUERQUE, NEW MEXICO 87110

IN REPLY REFER TO:
DES-75/43

Memorandum

To: Manager, Gulf OCS Office, New Orleans, Louisiana 70113

From: Regional Director, South Central Region

Subject: Draft Environmental Statement Concerning a Proposed Oil and Gas Lease Sale in the Gulf of Mexico (OCS Sale No. 41)

We have reviewed the subject draft environmental statement.

Impacts related to outdoor recreation have been adequately addressed.

Rolland B. Handley

AMERICAN REVOLUTION BICENTENNIAL 1776-1976

c. Department of the Interior

(3) Fish and Wildlife Service

This agency submitted comments pertaining to a wide range of topics.

Disposition:

The majority of the comments have been incorporated into the final environmental impact statement.

1.1 Additional material has been included in this statement in section II.#.4.

1.2 The boundaries established for the Flower Garden Banks were the result of a meeting held in Galveston, Texas on November 7, 1973. Those present included representatives from U. S. Fish and Wildlife Service, BLM, USGS, NOOA/NMFS, Texas A & M University of Texas, Shell Oil, Continental Oil, and other interested parties totaling 24; therefore, we believe a change in the stipulation is not warranted at this time.

1.3 A coral reef has been reported on the 28 fathom bank but its existence has not been verified by BLM. We have no data to indicate that the 28 Fathom bank supports hermatypic corals, i.e., Flower Gardens. In addition, the water depth (150 feet) is beyond the limits of reef building coral.

2.1 An industrial development plan is in included in Section II.K.C. Environmental impacts will follow any refinery, pipeline or terminal project.

2.2 Section I.C.3 has been revised in accord with this comment.

2.3 The area affected by the turbidity plume would be influenced by not only sediment characteristics and current, but also wind waves, tides, temperature gradients, etc. It would be necessary to have more information than is available at this time for us to make a good estimate of plume behavior (see section III.A.2).

The size of the onshore area affected is generally about 30-40 feet; however, a wider area may exhibit an alteration in drainage.

2.4 The geographic area encompassed by this proposed sale has in recent months been described by previous environmental impact statements prepared for other offshore lease sales. The Department of the Interior has encouraged the citing of past EIS's for assistance in describing the environment of an EIS area. At the same time, it is the responsibility of the agency responsible for the EIS to insure that the data used in the preparation of the statement is current and valid for the section on the description of the environment. If an area has not been properly treated in past EIS's, then additional information is sought. We feel that this concept has been met and that the requirements of NEPA are being complied with.

3.1 No definition of threse terms were given by the author. However, inner shelf implies 4 to 23 m, intermediate 24 5o 65 m, and outer shelf 66 to 120 m as defined by Parker (1960).

3.2 As this table lists only comparisons, it is believed to illustrate the data adequately.

3.3 The author in question is Briggs (1973).

3.4 This information has been incorporated into section II.E.3.

3.5 The authors did not define the terms "common", "occasional", and "rare" and their estimates were based mainly on visual observations.

3.6 & 3.7 These corrections have been incorporated in section II.E.4.

3.8 Please see reply to FWS comment 1.3.

4.1 & 4.2 Sections II.F.1 and 2 have been revised to incorporate these suggestions.

4.3 The statistics presented to Cobia in table 24, show an average weight per fish of approximately 1/2 lb. We agree that this is an extremely low figure as compared to other reports of average Cobia size; however, the source of this information (tables 3 and 5 of the National Marine Fisheries Service 1970 Saltwater Angling Survey lists these valves for this area and time period.

4.4 The volume of pompano was not enough to rank it. Pompano has a high dollar/pound value making it high in value, but the volume caught is low.

4.5 BLM used available data which indicates federal air quality standards, current emissions and occurrences of the established regions exceeding the federal standards. Thus, air quality from the various regions should be apparent from this data.

4.6 Although no specified level is established to delineate poor quality from good quality water, some inference can be made by reviewing the data on the biological oxygen demand and total

suspended solids for the counties along the Gulf of Mexico. Water with excessive BOD and TSS amounts are considered to be polluted because of adverse effects to normally occurring aquatic organisms.

4.7 Information relating to tourism and retirement has been included in section II.I.1b.

4.8 The biological environment is considered under sections I. E and F. The "Future environments without the proposal" would be similar to that described in these earlier sections should development not occur.

4.9 An estimate of the expected spills resulting from the sale would depend upon so many variables that it would not be credible.

5.1 Populations of fish may indeed have changed and the FEIS has been revised accordingly.

5.2 Mention of the role of Spartina in nutrient cycling has been incorporated into section III.A.5.

5.3 BLM is not able to predict the affect of an oil spill on a small population of marine mammals. A spill which contaminated a marine mammal community could jeopardize the stability of its population dynamics, but this would be difficult to evaluate.

5.4 The Okaloosa darter is found in Okaloosa and Walton counties, Florida as is now stated in section III.A.7.

5.5 Appropriate corrections have been made in section III.A.7.

5.6 The DEIS does not refer to the diet of the bald eagle as being piscirorous but states that "a large part" of the diet consists of fish. The suggestions of the Fish and Wildlife Service are in according with what is stated in the DEIS. However, emphasis on

a more varied diet for the bald eagle has been stated.

5.7 The statement does not claim that salt water intrustion into the marsh habitat has not been detrimental to the alligator. It states, rather, that such intrusion on a local basis will not affect eht total alligator population. Evidence for this fact may be seen in Louisiana where salt water intrusion has not stopped revitilization of the alligator community.

5.8 Trawling depths range from 30 to 270 feet.

6.1 The number of underwater stubs, which represent plugged well-heads that may be used as production wells, are unknown. However, these stubs are marked with buoys and are routinely maintained. Computation of total acreage is not possible; however, for each stub the area would be less than one acre.

6.2 Tracts 3 and 4 did not receive a proximity value for oil spills in any category since they both are estimated to be gas bearing tracts (see appendix A).

The area above and including the 25 fathom depth of the East and West Flower Garden Banks has been established as the critical zone. This is considerably smaller than the totally delineated banks. Our measurements indicate all tracts 14 and 27 as being beyond three miles from the critical depth.

6.3 Revisions have been incorporated into Section IV.D.

6.4 Please see reply to FWS comment 1.2.

6.5 A full discussion of the land requirements that might be anticipated as a result of oil and gas production and transportation activities was included in the Final Environmental Statement

prepared by BLM for OCS Sale # 32, a 1973 OCS general sale of acreage off the coasts of Mississippi, Alabama, Florida. The land requirements for a support facility are estimated to amount to 40 acres, and the acreage required for a storage and tanker facility also amounts to 40 acres.

7.1 A full discussion of the land requirements that might be anticipated as a result of oil and gas production and transportation activities was included in the Final Environmental Statement prepared for OCS Sale No. 32, a 1973 outer continental shelf general lease sale of acreage off the coasts of Mississippi, Alabama and Florida. The land requirements for a support facility are estimated to amount to 40 acres, and the acreage required for a storage and tanker facility also amounts to 40 acres.

7.2 & 7.3 These suggested corrections have been incorporated into the Final EIS.

7.4 The references have been corrected where appropriate.

ADDRESS ONLY THE DIRECTOR,
FISH AND WILDLIFE SERVICE

United States Department of the Interior

FISH AND WILDLIFE SERVICE
WASHINGTON, D.C. 20240

In Reply Refer To:
FWS/OBS

SEP 26 1975

Memorandum

To: Director, Bureau of Land Management

From: Acting Deputy Associate Director, Fish and Wildlife Service

Subject: Draft Environmental Statement Concerning a Proposed Oil and Gas Lease Sale in the Gulf of Mexico (OCS Sale No. 41)

The Fish and Wildlife Service offers the following comments on the subject statement.

General Comments

The draft environmental statement (DES) appears to adequately assess most aspects of the proposed lease sale. However, there are a few topics that could use further attention in the statement.

1.1 A major problem is the consideration given marine mammals, birds, sea turtles, and endangered species in Section II of the DES. This Sale includes tracts throughout the Gulf of Mexico, yet only two pages are included in Section II on these topics. We feel that this coverage is inadequate.

1.2 Also of concern is the stipulation designated to protect the biotic communities of the Flower Garden Banks. The circular area within which the disposal of drill cuttings and drilling muds is regulated is very close to certain portions of these irregularly shaped reefs. This potential problem should be avoided by redefining the restricted area so as to extend it outward three miles from the base of each reef.

1.3 Additional information should be provided concerning 28 Fathom Bank. This bank is referred to as a fishing bank in the text of the DES, but is shown to be a coral reef on Visual Graphic No. 4. The proper application of protective stipulations requires more precise knowledge of the bank's biotic characteristics.

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It is recommended that studies be conducted to more accurately define such factors as the distance from fishing banks that platforms should be placed in order to avoid conflicts with fishing activities. Studies should also be conducted to determine the distance to which drill cuttings and drilling muds are transported when disposed of by shunting, barging, and by release near the platform surface. This information is necessary to accurately determine the impact of drilling operations, and to properly apply protective restrictions in environmentally sensitive areas.

2.1 The statement is periodically made within the DES that no onshore facilities would be required as a result of the proposed lease sale and, therefore, no onshore impacts are associated with the proposal. This conclusion is questionable in view of the prediction that as many as two onshore terminals may be required as a result of this sale. In addition, with the cumulative effect of this sale and future development of existing leases (not to mention possible future leases) it would seem to be near certainty that the proposed sale would directly or indirectly result in impacts on land resources.

Specific Comments

2.2 P. 5 - Fifth line from bottom of page. The U.S. Fish and Wildlife Service makes recommendations for biological considerations, not limitations.

2.3 P. 8 - A better estimate of offshore pipeline burial disturbance than volume of material (4,000 to 8,000 cubic yards/mile) would be the area affected by the turbidity plume created during burial operations. Although the area affected by the plume would be greatly influenced by such variables as sediment characteristics and current, a range of possible plume sizes could be given. The size of the onshore area said to be affected by pipeline burial (a zone 30 to 40 feet wide) may also be somewhat misleading. Although a 30-to 40-foot wide zone is often trenched in marshes or maintained free of non-grass species in upland areas following construction, the actual area affected by construction activities would be about twice that width.

PP. 85-144, BIOLOGICAL OCEANOGRAPHY & BIOLOGICAL ENVIRONMENT OF THE COASTAL ZONE

2.4 The DES makes reference to previous environmental impact statements for detailed descriptions of the biology of the offshore and coastal zone environments. However, sufficient biological information should be provided in the DES to characterize the environment without relying totally on references to previous statements. This appears to have been done for planktonic organisms, but little, if any, information is given regarding the species composition and distribution of other life forms. For example, no information is given regarding the species composition of benthos, offshore Texas and Louisiana, and the discussion of the biological aspects of the coastal environment is generally limited to the eastern Gulf.

3.1 P. 108 - The terms inner, intermediate, and outer shelf should be defined.

Second paragraph is muddled. It states that species diversity is greater inshore and also offshore than it is inshore and offshore.

3.2 P. 109 - Table 4 gives some catch statistics without including any information about the amount of sampling and the relative efficiency of the sampling in each shelf zone.

3.3 P. 110 - A statement is made in the third paragraph about fish collections being made by "the author" without identifying the author.

3.4 P. 113 - Last paragraph. Hastings, Ogren and Mabry conducted a study relative to Navy platforms off Panama City, Florida. The report of this study, like Sonnier et al's report, is currently in press and will appear in the NMFS Fishery Bulletin series.

3.5 P. 115 - Table 5 does not define the terms "common", "occasional", and "rare", and there is no indication of how estimates of abundance were made.

3.6 P. 119 - According to Charles R. LeBuff, Jr. there are five species of marine turtles which inhabit Gulf waters near Sanibel and Captiva Islands. The Atlantic ridley, hawksbill and leatherback turtles are on the list of endangered species and the green and loggerhead turtles have been proposed for inclusion on the threatened species, but the hawksbill turtle is not listed in this DEIS.

The loggerhead turtle nests on Sanibel and Captiva Islands. L. Ogren, NMFS at Panama City, Florida, found a loggerhead turtle nest on the Chandeleur Islands. Specimens are in the Tulane Museum.

3.7 P. 120 - The West Indian (Florida) manatee should be mentioned as an endangered species.

3.8 P. 122 - 28 Fathom Bank is referred to in the text of the DES as a fishing bank, but is shown to be a coral reef on Visual Graphic No. 4. Although only relatively small portions of that bank may be of sufficient elevation to permit the growth of coral, the possibility of coral development should be considered along with the minimization of adverse effects on fishing activities in enforcing the provisions of stipulation c. given on pages 542-543 of the DES. Consideration should also be given to applying stipulation b. to 28 Fathom Bank, if it is found to support a significant coral reef community.

4.1 P. 130 - <u>Salt Marsh</u> - Two references do not cover adequately the available literature on salt marshes, and no references are included for the animal population that inhabit the marshes. The "higher vertebrates" that exist in the marshes because of the fish and invertebrates should be identified.

4.2 PP. 130-132 - <u>Mangrove Swamp</u> - This section provides some implied conclusions about the importance of mangroves in energy transfer that are not accepted generally. Literature references are needed to show where the information summarized in this section was generated.

4.3 P. 214 - Table 24 -- According to the data presented in this table, cobia averaged only about 1/2 pound each. This average should be much larger.

4.4 P. 270 - When ranking commercial species of fish, pompano was ranked seventh in value but was not ranked according to volume.

4.5 PP. 274-290 - <u>Air Quality</u> - This section does not treat adequately the problem of air pollution. The statements concerning the sparsity of data to cover the fact that air quality is unacceptable in some urban areas are misleading. If one were sampling to learn if standards had been exceeded, certainly the urban areas would be included in the samples. There are undoubtedly enough data available to evaluate the seriousness of the air pollution problem, so a thorough analysis should be done.

4.6 PP. 291-300 - <u>Water Quality</u> - This section presents some of the data available to assess water quality but there is no indication that water quality is desirable or poor.

4.7 PP. 301-357 - <u>Historical and Projected Economic Growth</u> - Nowhere in this section are tourism and retirement considered. Certainly many retiring people and tourists prefer coastal areas in which to live and spend their money. This should be a major impact in some areas, such as Tampa, Florida. This should be evaluated and the potential effects on these industries should be estimated for given petroleum related industry levels.

4.8 PP. 358-359 - <u>Future Environment Without the Proposal</u> - This title is misleading since the economics of producing additional oil and gas is all that is considered. The biological environment would involve habitats and biota other than those important to man.

4.9 P. 363 - It is stated that the probability of a major oil spill (100,000 gallons) resulting from the proposed sale in unknown. However, a figure of 1 spill per 1,000 wells drilled is given on page 503 for the probability of a 1,000-barrel spill. If the ratio of 1,000-barrel spills to major spills is obtainable from existing records of recent offshore activity, then a rough estimate of major spill probability should be possible.

5.1 P. 386 - Is enough known about the pre-oil drilling populations of fish to be sure that the populations have not changed? Data should be presented to substantiate this statement.

5.2 P. 394 - Spartina is referred to as playing an important role in the aeration and stability of the marsh. Not mentioned is the critical role that this plant plays in the cycling of nutrients.

5.3 P. 404 - The conclusion appears to have been made that since marine mammals are not abundant in the Gulf of Mexico, there is little chance that they would be affected by oil contamination. It could just as easily be concluded, however, that because there are relatively few marine mammals in the Gulf, any adverse effect on them would have a greater potential effect on the maintenance of their populations than would be the case if there were a large number of these animals. Also, the species of marine mammals involved should be named.

5.4 P. 406 - The paragraph on the Okaloosa darter should list the state in which the darter is found.

5.5 P. 407 - The last sentence should read: "The eagles are susceptible to nest site destruction...".

5.6 P. 408 - The bald eagle is omnivorous. A large portion of its diet may be fish but should it be considered as primarily piscivorous? Williamson and White, 1974, reported that during five years of study at Amchitka, Alaska fish accounted for only 20% of the bald eagle's diet; birds made up about 50%; mammals made up about 30%.

Williamson, F. S. L., and White, C. M., 1974. Amchitka Bioenvironmental Program. Studies of the avafauna on Amchitka Island, Alaska. Final Progress and Summary Report. Battelle Memorial Institute, Columbus Laboratories, U. S. AEC Report BMI-171-155. 28 p.

5.7 P. 409 - References are needed for the statement that salt water intrusion into freshwater habitats has not been detrimental to the alligator.

The hawksbill turtle should be included on this page as an endangered species.

5.8 P. 411 - Trawlers are already fishing at depths greater than 240 feet, especially for one species of shrimp. This deep water trawling will undoubtedly increase with improvements in technology.

6.1 PP. 411-414 - IMPACT ON COMMERCIAL FISHERIES

It is estimated in the DES that fishermen would be denied the use of 250 acres of the sea floor due to the interference of platforms with trawling operations. Since underwater stubs can also interfere with trawlers, a navigational safety zone, similar to that calculated for platforms (2 to 5 acres), should be determined for the estimated number of stubs which would result from the proposed sale. This figure should then be totaled and added to the original estimate of 250 acres to get a more realistic estimate of the seafloor acreage denied to fishermen.

6.2 PP. 493-502 - RECAPITULATION OF THE PROXIMITY EVALUATION

Several tracts appear to have been omitted from the proximity value listings given on pages 493 to 502. For example, Tracts 3 and 4 are both 11 miles from shore, but are not given a proximity value for oil spills under the categories "Beach and Shorelines" or "Intertidal Communities". In addition, portions of Tracts 14 and 27 appear to be located within three miles of known reefs, but are not given a proximity value for structures under the category "Reef Communities".

6.3 P. 538 - The reference to mean high tide and navigable channels as establishing federal responsibility for pipeline placement is no longer current. Section 404 of the Federal Water Pollution Act Amendments of 1972 establishes a permit program, administered by the Corps of Engineers, which requires federal review of development activities in navigable waters and adjacent wetlands. This would appear to include all coastal wetlands.

6.4 P. 541 - Stipulation b. establishes an aliquot area, bounded by the base of the East and West Flower Garden Reefs, within which no development activities are allowed. It also establishes a circular area, centered on each reef, within which drill cuttings and drilling muds must be disposed of by shunting or barging. Since a circle does not correspond with the perimeter of the reef, it is recommended that the shunting or barging restriction be placed on that area three miles outward from the base of the banks. This restriction was used to protect the banks affected by OCS Sale No. 37, and would bear a more direct relationship to the goal of protecting the reefs from potential impacts associated with materials released during drilling operations. It would also add a portion of Tract A-379 to the tracts already covered by this stipulation.

6.5 P. 566 - Substantiation should be provided for the statement that "Productivity of coastal lands in the area disturbed by pipeline operations will actually increase following disturbance, but will return to natural levels as original conditions are restored in subsequent growing seasons". Sediment disturbed by pipeline construction could increase productivity by releasing nutrients to nutrient-deficient systems, but could also release toxic materials or significant quantities of oxygen-demanding material which could reduce water quality and productivity. Poorly constructed or maintained

pipelines can also result in the drainage of wetlands, severely limiting the productivity of such lands. The productivity of upland areas can also be reduced by pipeline construction due to the burial of topsoil at the bottom of the trench during backfilling.

7.1 P. 568 - It is estimated that no expansion of onshore facilities will result from this sale, and, therefore, the loss of land resources is not a factor in the sale. Since it is also estimated that 0 to 2 onshore facilities may result from the sale (Table 1, Page 7), this statement should be changed to reflect the possible development of land resources.

7.2 PP. 756-816 - The "Summary of Scientific Results taken from Baseline Environmental Survey of the MAFLA Lease Areas" could be improved greatly by omitting the names of scientists working on various segments of the study. As written, it is difficult to know if a published report is being cited or if an acknowledgement is being made.

7.3 Volume 3 - All visual graphics that show the eastern Gulf of Mexico have the shoreline of Bay County, Florida shown incorrectly.

7.4 Also, all references should be verified during the preparation of the final EIS. In attempting to check on some references the following problems in identifying the report were discovered:

Page No.	Reference and Question
20	Kemp, 1970 - cited in text but not included in Bibliography
24	Meyerhoff, 1970 "
33	Gagliano, 1971 "
35	Turner et al., 1966 "
47	Texas A & M University, 1971 "
48	Bright, 1974 "
51	Oetking, 1974 "
51	Eleuterius, 1974 "
53	Manheim, 1974 "
55	Hyne & Goodell, 1967 "
55	Jordan & Steward, 1961 "

Page No.	Reference and Question
65	U.S. Army Corps of Engineers, 1970 - cited in text but not included in Bibliography
67	Eleuterius, 1974 "
72	Eleuterius, 1974 "
77	Camille, 1969 "
81	Manheim, 1974 "
81	Presley et al., 1974 "
81	Movitus, 1961 "
82	A Summary of Knowledge of the Eastern Gulf of Mexico, 1973 "
86	FAO, 1972 "
110	Berry, 1958a "
110	Berry, 1958b "
113	Smith (in press) "
113	Smith et al. (in press) "
128	U.S. Department of Commerce, 1974b "
161	U.S. Department of the Interior, 1974 "
170	Newton, 1972 "
171	State of Louisiana, 1967 "
179	Florida Department of Agriculture and Consumer Service, 1969 "
189	U.S. Department of the Air Force, 1974 "
196	National Marine Fisheries Service, 1972 "
196	Moe, 1963 "
197	Moe, 1963 "

Page No.	Reference and Question	
216	Christman, 1973 - cited in text but not included in Bibliography	
216	Swingle, 1973	"
216	Bryant, 1973	"
242	Department of Army - Corps of Engineers, 1971	"
256	Texas Archaeological Research Laboratory, 1974	"
267	Zuhl, 1974	"
268	Petrocelli, 1974	"
273	U.S. Geological Survey, 1975	"
278	Texas Air Control Board, 1972	"
304	Gunther, 1975	"
306	Thompson, 1972	"
332	Minerals Yearbook, 1973b	"
333	U.S. Department of the Interior, Bureau of Mines, 1974	"
334	U.S. Department of the Interior, Bureau of Mines, 1974	"
336	FPC News, 1973	"
339	Oil and Gas Journal, 1974	"
345	Whitehorn, 1973	"
347	Whitehorn, 1973	"
354	Stephens, 1973	"
362	USGS, 1974	"

Page No.	Reference and Question
375	Shelton, 1972 - cited in text but not included in Bibliography
376	Blumer et al., 1970a "
384	NAS, 1973 "
395	Baker, 1971 "
395	Baker, 1969 "
396	Baker, 1971 "
396	Nelson-Smith, 1972 "
401	Bourne, 1968 "
401	Clark, 1973 "
402	Straughan, 1970 "
403	Rittinghaus, 1956 "
403	Peller, 1963 "
403	Wragg, 1954 "
416	Ketchum, 1973 "
416	Clark, 1973 "
419	Scarrot, 1971 "
421	Snow, 1974 "
465	Bureau of Mines, 1964 "
476	Minerals Yearbook, 1972 "
617	USDI, 1974 "
752	McGinnis, 1972 "
764	Palaces, 1975 - not enough information in Reference section
764	Atkinson & Wallace, 1975 - not enough information in Reference Section

c. Department of the Interior

(4) Geological Survey

This agency submitted comments covering a wide range of subjects.

Disposition:

The majority of the detailed comments and suggested changes have been incorporated into the final environmental impact statement.

1.1 through 3.11 These revisions and corrections have been incorporated into the Final EIS in the appropriate sections.

4.1 Figures 6 will be changed as soon as Dr. Gagliano presents new data on sea level fluctuations.

4.2 - 4.8 These corrections have been incorporated into section II.A.5.

4.9 The numbers shown on the banks in Figure 7 indicate their probable depth in fathoms. An index to these banks would not be meaningful, however, these banks are shown in greater detail in graphics 4, Vol. 3.

4.10 - 4-15 These corrections have been incorporated into section II.A.5.

4-16 This statement was included in the biological oceanography section II.E.

4-17 This correction has been incorporated into section II.E.3.

4-18 Information for this graphics was taken from FAO. 1972. Atlas of the Living Resources of the Seas, Rome, Italy and represents only a general depiction of shrimp migrations. However, corrections and additional data have been included in these graphics. A discussion on accenting potential fisheries was not included

because of the lack of substantial data beyond that covered in the commercial fisheries section.

5.1 - 5.8 These revisions and corrections have been incorporated into the Final EIS in the appropriate sections.

6.1 The range of oil concentrations reported were those listed in an EPA study in 1974 and are not meant to reflect supposed limitations.

6.2 - 6.3 These corrections have been incorporated into section III.A.1 and 2.

6.4 The "we" refers to the Department of the Interior, Bureau of Land Management, New Orleans OCS Environmental Assessment Staff.

6.5 - 6.9 These suggestions have been incorporated into the Final EIS.

6.10 Our position has been the proper exploration and development of the OCS by all user groups with the least amount of interference and effect on the environment.

Determination of acreages of trawable bottoms is also in a category of the unknown due to the many factors causing physical interference with trawling and the ecology of the species being sought. In other words, esactly where is the species caught and how often.

The placing of drilling and production activities as close as possible to a bank area has not been shown to be environmentally safe. However, we are presently conducting studies to determine the effect of drilling activities on undersea features, i.e., banks and reefs.

We concur with the hypothesis that platforms act as islands of

refuge and enhance long term productivity in areas that were previously barren, see Section III.A.8c. Extending this hypothesis to areas that have existing reefs or banks has yet to be documented. Additionally the environmental effects have yet to be proven either beneficial, harmful or without effect.

7.1 - 7.8 These revisions have been incorporated into the Final EIS.

7.9 We believe that this was fulfilled in Section II.E.5.

7.10 - 8.3 These suggested corrections have been incorporated into the Final EIS.

United States Department of the Interior

GEOLOGICAL SURVEY
12201 SUNRISE VALLEY DRIVE
RESTON, VIRGINIA 22092

October 1, 1975

Memorandum

To: Chief, Branch of Marine Environmental Assessment
Division of Marine Minerals, Bureau of Land Management

From: Conservation Division Task Force Contact
U. S. Geological Survey

Subject: Review of draft environmental statement concerning a Proposed Oil and Gas Lease Sale in the Gulf of Mexico (OCS Sale No. 41)

Enclosed are our comments on the subject statement.

William J. Hewley
Conservation Division Task Force Contact

Comments on Proposed Oil and Gas Lease Sale in the Gulf of Mexico (OCS Sale No. 41)

Conservation Division Task Force Contact
U. S. Geological Survey

1.1 Page 5, line 2 - "In March 1975, BLM requested a complete geologic...." The word "complete" probably should not be used because it is not likely a complete evaluation (prospect evaluation) was done on this date.

paragraph 1, last sentence - "bases" should be "cases".

1.2 Page 10, paragraph 1 - BLM permits, which account for the major portion of OCS pipeline mileage, should also be noted.

1.3 Page 16, paragraph 2, sentence 2 - "A controversy exists over the assumption that the Gulf has been permanent ocean basin," should be omitted.

1.4 Page 16, paragraph 2, line 3 - "The abyssal Gulf is underlain by a sematic (ocean type) crust; however, Wilhelm and Ewing (1972) believe that this crust developed in the last Paleozoic." The word "however" should be omitted and the word "last" changed to "late".

1.5 Page 16, paragraph 2, line 6 - should be changed to: In the Jurassic (180 to 150 million years age) the Gulf was a shallow enclosed sea similar to the present Caspian Sea in southwest Asia, and extensive evaporites of salt and anhydrite were deposited.

1.6 Page 18, paragraph 2, line 1 - should be changed to: The area of most available data on coastal Texas is from the Bureau of Economic Geology, University of Texas.

1.7 Page 20, paragraph 1 - Suggest this be rewritten and divided into three paragraphs as follows:

It should be noted that Louisiana is particularly in need of a modern compilation of coastal Geology. The source that is presently the most complete and reliable is the 1970 compilation by E. B. Kemp. He used LeBlanc's (1948) map and other numerous modern studies. Another modern study of importance for south-central Louisiana is the joint Corps of Engineers-Sea Grant, Environmental Atlas Report No. 8 Volume 2 by Gagliano et al. (1973). Also, the Corps of Engineers in New Orleans will be printing a new map of the geology of south-central Louisiana at a scale of 1:250,000 as part of their extensive river basins study program.

Alabama should be noted for producing detailed modern maps of their state on a county wide version as well as a 1:5000,000 version reduced from the larger scale maps.

Mississippi Geological Survey (Moore, 1969) has produced an impressive cross section of the state from numerous well and seismic exploratory data detailing the structure and stratigraphy of the area. A recent study of note in the north-central Gulf is the Mississippi Superport Study by the Gulf Coast Research Laboratory, Ocean Springs, Mississippi (C. K. Eleuterius, 1975).

2.1 Page 21, line 6 - Heading should be changed to:

3. Petroleum Source and Potential Reservoirs

a. Eastern Gulf

2.2 Page 22, paragraph 2 - Suggest the paragraph be rewritten: The oldest sediments overlying the basement to the south and the Louann salt to the north are Upper Jurassic in age, and they, in turn, are overlain by Lower Cretaceous, Upper Cretaceous, and Cenozoic rocks.

2.3 Page 22, paragraph 3, line 3 - Suggest second sentence be changed to: From its updip position in northeastern Florida it thickens to over 5000 feet towards the southwest across the Florida panhandle. There it consists of continental, deltaic, and marine sandstone, shales, and some evaporites together with some carbonates, including the prolific oil producing Smackover limestones and dolomites.

2.4 Page 22, paragraph 3, last sentence - Suggest this sentence be omitted.

2.5 Page 22, paragraph 4, line 3 - "Cretaceous age" should be added: "Presumably there is a Cretaceous age barrier-reef....."

2.6 Page 22, last paragraph, last sentence - Suggest this be broken into two sentences, as: The trend extends as far south as 27°N latitude. The occurrence of evaporites in the Lower Cretaceous of southern Florida indicates restricted water circulation which could be due to the barrier.

2.7 Page 23, paragraph 2, first sentence - use "where they" in place of "and". ".......into shallow water carbonates <u>where they</u> reach a ......"

2.8 Page 23, paragraph 3, line 2 - Suggest this be changed to: The section offshore from Mississippi, Alabama, and Florida is mostly carbonate with an average thickness of 6,000 feet and a maxiumum thickness of 8,000 feet.

2.9 Page 24, paragraph 1, line 1 - Suggest this be rewritten to: The most productive zones in these states are the Upper Jurassic, Lower and Upper Cretaceous. The main producing formations are the Tuscaloosa, Eutaw, and Paluxy, all of which are sands (Rainwater, 1970; Meyerhoff, 1970; and Braunstein, 1958). Production in Florida

is limited to the Upper Jurassic, although several hundred wells have been drilled. The Jay Field, located in Santa Rosa County in the panhandle, was discovered in 1970 and is producing from the Upper Jurassic Smackover Formation which is a very prolific oil producing limestone and dolomite onshore Mississippi, Alabama, and Florida.

3.1 Page 24, paragraph 3, line 3 - Suggest the last sentence be changed to: Production from the Lower Cretaceous is anticipated to be from carbonates in south Florida, but sands are the most prospective in the Offshore Panhandle Florida Area.

3.2 Page 24, last paragraph - Suggest this be changed to: Upper Cretaceous and Tertiary rocks are not considered as prospective with the possible exception of the Lower Tuscaloosa sandstone in the northernmost part of the area, and perhpas some Lower Miocene-Oligocene "reefs" to the northwest.

3.3 Page 25, line 8 - Heading should be changed to: b. Central and western Gulf

3.4 Page 26, paragraph 2 - A series of regional faults, commonly called "growth faults" are present in the Texas-Louisiana subsurface. They are aligned approximately parallel to the coast. These are normal faults, long and accurate in horizontal plan, with large amounts of vertical displacement downwards into the coastal basin. Rock units commonly show greater thicknesses on the downthrown sides of these faults; thus fault movement and deposition must have been essentially contemporaneous. The downthrown section acted as a topographic depression for localized deposition.

3.5 Page 28, paragraph 3, line 5 - Suggest a change to: Further to the west this producing trend dies out due to the lack of reservoir quality sand units.

3.6 Page 28, last sentence - omit last part of sentence: "...of sediments, predominately clay are found on the continental slope." Add "is" - "...but is at least 10,000 feet."

3.7 page 29, paragraph 2, line 1 - Capitalize "Formation" after "Frio".

3.8 Page 29, paragraph 3, line 11 - add "the": "...is the thickest in the Gulf..."

3.9 Page 36, paragraph 2, line 2 - change "vertical movements" to "vertical directions"

3.10 Page 41, paragraph 1, line 5 - do not capitalize "tsunamis"

3.11 Page 42, paragraph 2, last line - add to paragraph: "...are a significant hazard however. Although geophysical techniques cannot detect high pressure zones directly, velocity and amplitude anomalies have been identified which are abnormally pressured.

4.1 Page 45 - Figure 6 should be changed to one approved by Dr. Sherwood Gagliano (BLM consultant)

4.2 Page 46, line 2 - Suggest a change to: "The top of the Pleistocene in some areas is recognizable on high resolution seismic records."

4.3 Page 46, line 18 - "Texas <u>OCS</u> area."

4.4 Page 46, line 22 - capitalize "Zone Four"

4.5 Page 47, fifth line from bottom - capitalize "Bo'sun"

4.6 Page 47, last line - spelling "Pequegnat"

4.7 Page 48, line 2 - spelling "comprise"

4.8 Page 48, paragraph 2, line 11 - Graphic Number 4 instead of "Number 3".

4.9 Page 49 -An index to the banks keyed in Figure 7 is not presented.

4.10 Page 50, line 7 - spelling "nonexistent"

4.11 Page 50, paragraph 2, line 2 - "Graphics #3 and #3" should be limited to Number 2 of the Central Gulf of Mexico.

4.12 Page 50, paragraph 2, line 3 - capitalize "Quaternary"

4.13 Page 53, line 2 - spelling "pinnacles"

4.14 Page 53, paragraph 2, line 7 - omit "further"

4.15 Page 56 - Omit entire page; wrong conclusion.

4.16 Page 72, paragraph 1 - References could be considered that indicate larval recruitment from the Caribbean which contributes to the high values of species diversity of pelagic and benthic forms found in the Eastern Gulf.

4.17 Pages 113 and 114 - It is recommended that some mention be made of biomass in addition to the number of different species.

4.18 Page 114, paragraph 2 - (2) - The visual graphic Number 5, <u>Migration of Penaeid and Main Fishing Grounds</u> misrepresents the movement (migration) of larvae and juvenile shrimp. Shrimp biologists familiar with the Gulf of Mexico should be consulted.

Graphics Number 4, Volume 3, A designation should be made between those fishing stocks utilized and those which make up a potential fishery. An expansion in the text could utilize Bullis and Carpenter for accenting potential fisheries.

5.1 Page 121, paragraph 3 - Although the Gulf of Mexico is an arm of the Atlantic Ocean, it might be an extreme interpretation to consider the West and East Flower Garden Banks, off Texas, as "...on the eastern coast of North America".

5.2 Page 128, paragraph 2, line 6 - "The Mississippi contributes most of the nutrients to the estuaries of Louisiana...." The citation is missing from the bibliography. Although this statement emphasizes the contribution of nutrients to the central Gulf's extensive offshore estuarine zone, it should be remembered that the mainstream the Mississippi is walled in by levees throughout its course through Louisiana and nutrients are discharged far seaward of the shrimp nursery and oyster fishery. The inshore estuarine zone with its associated marshlands has an equal or greater nutrient generative capacity that influences the spring of life landward of the shoreline.

5.3 Page 267, paragraph 1, last line - Zuhl is not cited in the bibliography.

5.4 Page 273, paragraph 1 - This paragraph should read, "As of July 31, 1975, there were 5,449 active zone completions in the OCS of the Gulf of Mexico."

5.5 Page 273, paragraph 3 - should be updated:

<u>1974 GOM production</u>

oil and condensate	344 million bbl.
gas	3.5 trillion cubic feet

<u>cumulative value of offshore production through 1974</u>

$19.9 billion

5.6 Page 273, paragraph 4 - Based on 1974 production figures, OCS is producing 11.16% of the domestic crude oil and 16.05% of the domestic gas.

5.7 Page 360, paragraph 1, line 3 - The sentence "The Northern area of the Gulf of Mexico is no different from any other tropical or subtropical body of water (General Gulf, Graphic 3, Volume 3)" needs modifying to conform with the accepted rationale of geography. Also, upon analysis, one may find that the discharge of the Mississippi River and the large amount of rainfall along the central coastline contributes to the highly productive inshore and offshore estuarine zone and these factors, together with other regional conditions, certainly characterize the Northern Gulf of Mexico as a unique area biologically, chemically, geologically and physically.

5.8 Page 360, paragraph 2, line 6 - Sentence should read, "In accordance with Federal Regulations, OCS Order No. 7, the cuttings will be washed of <u>oil</u>."

6.1 Page 362, paragraph 3 - It should be noted that the OCS Orders limit the average oil content of discharged water to 50mg/l and that discharges above this level are infrequent and usually the result of operational problems.

6.2 Page 363, paragraph 2, line 4 - Should read "...a minimum chlorine residual of 1.0mg/l" rather than "...not greater than 1.0mg/l of chlorine residuals."

6.3 Page 369, paragraph 4, Line 2 - First sentense should read "...cuttings will be washed of oil."

6.4 Pages 369, 370, 383, 391, 419, and 450 - Several instances exist in the text that refer to "we feel", "we expect", "we believe", and "our opinion". It is not clear to whom these refer.

6.5 Page 374 - Comments on page 362 related to the oil content of discharged water apply also to the table on this page.

6.6 Page 383, paragraph 2, line 1 - Change "Nektic" to Nektonic.

6.7 Page 391 - Stipulation identification is inconsistent with pages 539, 540, 541, 542, 543, 544, and 545.

6.8 Pages 392 and 393 - Figures 30 and 31 are duplicates.

6.9 Page 411 - Print on the entire page is illegible in some copies.

6.10 Pages 411, 412, and 413 - The discussion on the removal of the sea floor from use would be more meaningful if all multiple uses and their values of the seabed were discussed. Perhaps estimates on the competitiveness of the trawl fisheries could be better evaluated if acreages of trawlable bottoms and the values of each depth zone were determined. These evaluations might be used to supplement the text. This rationale could also be applied to all stipulated areas and expanded to relate to the overall multiple use of available resources.

The assumption that drilling and production activities may remove trawlable bottoms from the shellfish and finfish fisheries emphasizes the consideration of placing these activities as close as possible to bank areas or untrawlable bottoms. The placement of a platform might affect the area's potentiality for being fished with a trawl. But before a greater indepth analysis of fishing areas are conducted it is hazardous to equate that trawling effort equals harvest. There has been some undocumented evidence and rationalizations by members of NMFS Exploratory Laboratories that platforms may act as islands of refuge. By extending this hypothesis, there is a potential for enhancement of long term productivity.

7.1 Page 417, line 5 - Ehrhardt (1972) only reported what someone else investigated or "found".

7.2 Page 425 - The commentary entitled "Impact on Air Quality" should include some discussion of the positive impacts of increased natural gas production. Natural gas is the cleanest burning fossil fuel, creating no particulate matter, virtually no sulfur compounds, and far less nitric oxides than any other common fuel. Of the major fuels, natural gas can make the most significant contribution to alleviating air pollution.

7.3 Page 433, paragraph 1 - A source should be given to support the statement that formation waters may contain significant concentrations of heavy metals. Measurable quantities of toxics have been detected in isolated samples of formation water, but we have seen no data which indicate consistent significant quantities for a particular source.

7.4 Page 496, first line in table - Change E1-57 to EI-57.

7.5 Page 496, line 5 under "Proximity Value" - Change H-81 to A-81.

7.6 Page 516, paragraph 1, line 8, last 2 sentences - Should be changed to: An average reporting period from February through April, 1975 resulted in approximately 3,000 subsurface safety valves being checked. Of this amount, there were 174 failed components detected in the valves, but a number of the valves had more than one failed component.

7.7 Page 539 - Bottom of page, section a., should read: "If the Supervisor..." (not the Manager).

7.8 Page 539 - The latest revisions to this stipulation only add to the costs. The proposed stipulation alters the historical role of the BLM Manager by allowing him to determine the jurisdiction of the stipulation subsequent to leasing. We believe this authority should remain in the hands of the Oil and Gas Supervisor, who bears the responsibility for supervising activities on OCS leases.

7.9 Page 542, stip. c. - Lease stipulations, which require special operating practices and tract surveys, should be applied only when the need and the intent of each specific requirement is itemized before such a stipulation is applied.

7.10 Page 545 - All of section (3) should be omitted since the disclosure date for Geological and Geophysical data is in a state of flux.

7.11 Page 628 - Incomplete citation in bibliography for: Cockrell, Johnston, Moritas, Pyle, Setlow, Snow.

7.12 Page 716, paragraph 4 - Delete; supplies incorrect information.

7.13 Page 734, last paragraph, line 2 - "actuaion" should be "actuation"

8.1 Page 736, paragraph 4 - "Drill Cuttings" - Table 1 shows mud additives only and not the volume of cuttings generated. The cuttings generated are listed in the second paragraph on page 736.

8.2 Page 759 - TAMU - Change College Park to College Station, Texas.

8.3 Page 760 - Page numbers are wrong.

c. Department of the Interior

(5) <u>National Park Service</u>

The National Park Service reviewed the Draft Environmental Impact Statement (OCS Sale No. 41) and had no comments.

United States Department of the Interior

NATIONAL PARK SERVICE
WASHINGTON, D.C. 20240

IN REPLY REFER TO:
L7619-MQ

SEP 25 1975

Memorandum

To: Director, Bureau of Land Management

Through: Assistant Secretary for Fish and Wildlife and Parks

From: Associate Director, Park System Management

Subject: Draft Environmental Statement Concerning a Proposed Oil and Gas Lease Sale in the Gulf of Mexico (OCS Sale No. 41) (DES 75-48)

As requested in the memorandum of August 19, 1975, we have reviewed the subject statement and have no comments.

AMERICAN REVOLUTION BICENTENNIAL 1776-1976

d. Energy Research and Development Administration

The Energy Research and Development Administration submitted comments pertaining to a wide range of subjects.

Disposition:

The majority of the comments and suggested changes have been incorporated into the Final Environmental Impact Statement.

1.1 The recently published (May 1974), Energy Alternatives, A Comparative Analysis, prepared for several Federal agencies, including the Bureau of Land Management, by The Science and Public Policy Program, University of Oklahoma, includes a thorough discussion of alternative sources of energy. This publication is available from the U. S. Government Printing Office, Washington, D. C. 20402 (Stock No. 041-011-00025-4). Please refer to section VIII.

3.1 The subsidence problem in Texas and Louisiana is, according to groundwater specialists, attributed mainly to pumping of groundwater in Texas to supply water for municipal and industrial uses (mainly refinery and petrochemical installations). In Louisiana subsidence is also attributed to compaction and shrinkage in drained marsh areas. Oil and gas removal would constitute a minor cause for subsidence usually attributed only to near surface reservoir sands.

3.2 We agree that it is difficult to interpret the impact of drill cuttings and waste water near platforms due to the incomplete bottom current information for the Gulf of Mexico.

3.3 We agree that oceanographic data is usually sketchy; however, BLM is presently conducting baseline and monitoring studies to adequately assess the impact of offshore oil and gas operations. Additionally, special studies are also being generated to provide impact assessments from OCS activities.

3.4 The trace metals singled out for analysis are those metals most detectable as variables due to industrial dumping or offshore drilling operations. These were designated by BLM research members as a committee of experts in the field.

3.5 This correction has been made in section II.D.3.

3.6 Section II of this environmental statement attempts to describe the environment of the area offered for lease and of the adjacent coastal zone. At this point we do not know which tracts (if any) will be leased, and of those which may be leased we do not know which tracts (if any) will develop commercial oil or gas production. Thus, direct and specific impact relationship is both difficult and, we feel, inappropriate in this section. More specific land use impacts are discussed under several headings in Volume II, particularly III F. and III K.

3.7 The military areas discussed in section II.G.2b are of particular concern because of the hazard from unexploded ordnance and this hazard would continue to exist even if future military activities were relocated.

3.8 This correction has been made in section II.C.

3.9 In some cases, quantitative evaluation of the exact nature of certain effects of oil and gas development was not possible. In

these instances, an attempt has been made to reasonably estimate the impact based on available information.

b) Comments addressed by changes in section III.A.1.

c) This section cites as a reference scientifically generated information. No changes were deemed necessary.

d) The statement is made that turbidity is a temporary result of pipeline burial but no mention is made of the effects being loca. The temporal nature of burial generated turbidity is well documented by observation.

e) Comments addressed by changes in section III.A.2.

4.1 This suggestion is incorporated into section III.B.

4.2 Based on available data and studies we addressed all unavoidable adverse effects of OCS activities deemed appropriate. BLM agrees the overall ecosystem approach is most important.

UNITED STATES
ENERGY RESEARCH AND DEVELOPMENT ADMINISTRATION
WASHINGTON, D.C. 20545

OCT 3 0 1975

Manager
Gulf OCS Office
The Plaza Tower - Suite 3200
1001 Howard Avenue
New Orleans, Louisiana 70113

Dear Sir:

This is in response to the transmittal dated August 19, 1975, from Mr. Frank A. Edwards inviting the U. S. Energy Research and Development Administration (ERDA) to review and comment on the Department's Draft Environmental Statement concerning a proposed Gulf of Mexico, Outer Continental Shelf (OCS) oil and gas lease sale (OCS Sale No. 41).

1.1 We have commented previously on similar documents and have suggested that the Department provide a better technical description and potential impacts of alternative technologies, especially nuclear. However, we are concerned that this suggestion has not resulted in an across-the-board treatment for other technologies. A case in point is the three page cursory treatment of coal and coal conversion. We feel that the weighing of alternatives is in order in the discussion rather than to merely recognize them as alternative technologies. In this regard, we feel that there is a lack of qualitative and quantitative assessments of the impact of the proposed action and suggest that this area be strengthened in the Final Statement. For example, starting on page 569, the alternatives to the proposed lease are treated in a qualitative superficial manner. The coal discussion indicates up to 27 million tons of coal <u>per year</u> would be necessary to compensate for not leasing these 85 tracts. There are two problems with this assessment: first, calculations using approximately 4 barrels of oil/ton of coal, indicate that less than 100 million tons of coal would be needed as a total replacement of the projected 300 million barrels of oil from this sale, instead of 27 million tons per year for an undetermined number of years as indicated in the EIS.

In addition, the quantitative discussions such as coal being an imperfect substitution for gas, the possibility of land subsidence, associated water quality problems during the fuel cycle, public concern over mine conditions all hinder an objective and quantitative cost/benefit relationship between coal and these 85 oil/gas tracts. We do not feel that one can objectively evaluate the lease without a more substantive

cost-benefit analysis of the alternatives.

Thank you for the opportunity to provide these comments. Additional Staff comments are provided in the enclosure.

Sincerely,

W. H. Pennington
Office of the Assistant Administrator
for Environment and Safety

Enclosure:
As stated

cc: CEQ (5)

ERDA Staff Comments
on the U. S. Department of the Interior
Draft Environmental Statement
prepared for the
Outer Continental Shelf Sale No. 41

3.1 1. Volume 1 represents a good overview of the marine environment into which this OCS activity will impact. However, the link between the oceanographic information in this volume and the cost-benefit analysis in Volume 2 was not always made. For example, in the Geology section, the subsidence problem was flagged as being of prime concern to those living in the low coastal areas of Texas and Louisiana but the potential lowering of this area due to continual removal of subsurface oil was not made.

3.2 In the Physical Oceanography section it was emphasized that bottom current measurements were rare so circulation patterns and resulting flow patterns of the drill cuttings around platforms is controversial. Therefore, it would be difficult to properly evaluate these impacts.

3.3 In the Biological Oceanography section, the matrix in Table 2 shows most of the knowledge (80%) is either poor or fair. This also makes an estimate of the OCS impacts on the biological community difficult but this should be expedited in Volume 2.

3.4 2. Page 81: The first paragraph on trace metals is not complete. What does major mean? Why are these eleven metals singled out as being important over the other 70 metals in the periodic table that are also less than 1 ppm?

3.5 3. Page 82: Line 2 - Corcoran's study of 1972 did not include Clostridium.

3.6 4. Page 145: Land use section: Tables 8, 9, 10, 11, 12, and 13 are merely statistical summaries of the land use in each state along the Gulf Coast and are not directly related to impacts of the OCS lease.

3.7 5. Page 188: If a proper cost-benefit were made between the OCS activities and other competing uses of the shelf such as the military uses, some of these latter activities could be relocated.

3.8 6. Page 432: Our calculations indicate that the proposed lease will not produce 100-300 billion barrels of oil, but approximately 10^{-3} less.

3.9 7. Volume 2, Section III: Although this section is responsible to quantitatively define the environmental impact of the proposed sale, vague and general evaluations are repeatedly made throughout from pages 360 to 552. They are far too numerous to identify them all. The major criticism is that the oceanographic data is not available to support these qualitative assessments. The following five examples from Impacts on Living Components are examples of our concern:

(a) Page 361 - plankton recovery rates would be rapid from discharge of drill cuttings.

(b) Page 362 - impact to primary producers would be temporary and insignificant due to pipeline burial.

(c) Page 364 - once an oil spill episode has passed only a few cells are needed to repopulate a given area rapidly and recruitment quickly achieves a normal phytoplankton population.

(d) Page 372 - turbidity effects from pipeline burial operations will be temporary and local.

(e) Page 380 - in the event of an oil spill certain benthic assemblages will be effected.

4.1 8. Page 426: Impacts on air quality table should remind the reader that the stated amounts of CO_2, SO_2, and NO are from 1000 barrels of oil.

4.2 9. Volume 2, Section V: Unavoidable Adverse Effects: The same philosophy should be used toward parts A (Marine Organisms), B (Wetlands and Beaches), C (Air Quality), D (Water Quality), E (Commercial Fishing) and F (Ship Navigation) as is planned for part G (Damage to Archaeological Sites). Part G studies require a thorough, detailed examination for underwater potential cultural resources prior to leasing these sites with possible shipwrecks and other archaeological resources. We feel that the eco-system is somewhat more important than historical relics; however, a more thorough and detailed quantitative analysis of <u>all</u> impacts of OCS activities should be made prior to leasing.

e. Environmental Protection Agency

This agency submitted comments concerning a wide range of subjects.

Disposition:

The majority of the comments received from the Environmental Protection Agency were incorporated into the final environmental impact statement.

1.1 The tracts referred to in this comment are located in an area of extensive development, both offshore and in the inland waters and marshes of the State of Louisiana. The OCS Manager has analyzed all factors concerning these tracts during the tract selection process and has concluded that the offering and possible subsequent leasing of these tracts would have a negligible impact to the area.

3.1 This revision has been made in section III.C.

3.2 Pipeline management studies have been programmed into the overall management scheme of the Federal OCS. If and when the need for a pipeline is recognized, such a study will be conducted and the concerns presented here will be considered. Since most sedimentary toxic pollutants will be found with state waters, close coordination with the states is anticipated.

3.3 - 3.5 These suggested revisions have been made in the appropriate sections of the Final EIS.

4.1 Data pertaining to emission rates for stationary power units, service vessels, and hydrocarbon releases from routine losses have been requested and will be included in future impact statements.

4.2 Additional information pertaining to oil spills have been added to section III.B.

4.3 The sulfur content of crude oil from the Gulf of Mexico ranges from 0.1 to 0.5% sulfur (see Section III.B.

ENVIRONMENTAL PROTECTION AGENCY
WASHINGTON, D.C. 20460

OCT 20 1975

OFFICE OF THE
ADMINISTRATOR

Mr. Curtis J. Berklund, Director
Bureau of Land Management
U.S. Department of the Interior
Washington, D.C. 20240

Dear Mr. Berklund:

The Environmental Protection Agency in accordance with its responsibilities under the National Environmental Policy Act and Section 309 of the Clean Air Act has reviewed the Bureau of Land Management's draft environmental impact statement entitled "Proposed 1976 Outer Continental Shelf Oil and Gas General Lease Sale, Gulf of Mexico (OCS Sale No. 41)." Specific comments are attached.

1 In general, we believe the statement adequately analyzed the environmental impacts associated with the proposed action. We have no objections to the offering of the majority of the tracts selected. However, we have serious reservations concerning the offering of three small tracts (BS-71, S-66 and MP-69) which are oil prone tracts and in close proximity to wildlife management areas (Breton National Wildlife Refuge Area, Delta Migratory Waterfowl Preserve, and the Pass a Loutre Game and Fish Preserve) and to beaches and shorelines, intertidal and reef communities.

The remainder of our comments are addressed to problems involving platform discharges, heavy metal accumulation, oil spill cleanup, and air pollution impacts.

In accordance with the EPA rating system for environmental impact statements, we are classifying this statement as LO-2. EPA has no objections to the proposed lease provided that the three small tracts mentioned above are deleted from the sale.

We appreciate the opportunity to have received this statement and hope that our comments will be of assistance in the preparation of the final statement.

Sincerely yours,

Peter L. Cook for

Sheldon Meyers
Director
Office of Federal Activities

Attachment

Environmental Protection Agency
Comments on
Draft Environmental Impact Statement on
Proposed 1976 OCS Oil and Gas General Lease Sale,
Gulf of Mexico #41

3.1 1. On September 15, 1975, the Environmental Protection Agency published in the Federal Register (40 CFR 435) a notice of interim final effluent limitations guidelines and new source performance standards for the offshore segment of the oil and gas extraction point source category. The guidelines and standards represent the Agency position on the discharge of produced water, sewage, drilling muds, and other pollutants from the offshore sites. References to the provisions contained in the above notice should be made in the final statement.

3.2 2. Dredging associated with pipeline burial may, as stated, result in the resuspension of toxic heavy metals and persistent pesticides. We feel that BLM could predict many of the impacts to water quality by preceding pipeline dredging with a program of sediment and water quality analyses. This would not only allow for determination to be made of possible impacts but also provide necessary baseline information from which measures to mitigate impacts could be developed.

3.3 3. The effectiveness of offshore cleanup is weather contingent. The equipment which is now stockpiled and available as well as that which will be built in the near future, can not effectively operate in high winds or waves. Thus, existing spill control capabilities are not adequate to cope with a major spill offshore, primarily due to dependence on good weather conditions. Therefore, offshore cleanup operations are not as dependable as might be implied by the environmental impact statement.

3.4 4. The statement did not discuss shoreline cleanup technology and associated impacts. It should be more clearly expressed that once a spill arrives ashore, it is generally too late for effective mitigative measures, and cleanup itself may have unfavorable impacts which extend beyond contamination of an area by the oil. The areas of high risk potential which have been identified for oil spill impact will have to be considered as subject to extensive potential contamination.

3.5 5. The statement did not discuss the disposal of spill contaminated debris. If a spill involves a large quantity of oil contaminated debris, the disposal of the debris may pose a problem. The residents of shore communities are becoming increasingly reluctant to commit their disposal sites, which are of limited capacity, to the disposal of debris resulting from a spill arriving on their shores. If the debris is not disposed of properly, secondary contamination of surface or ground waters can result. Therefore the treatment of debris should be addressed as a potential impact.

4.1 6. This statement does not provide sufficient information concerning the levels of routine emissions from development and production phases of these leases. The final impact statement should provide emission rates for stationary power units, service vessels, and hydrocarbon releases from routine losses.

4.2 7. We question the statement that a large oil spill will only constitute a local air quality problem. A large oil spill would set up local conditions suitable for long distance air mass transport, which could produce both health and welfare effects on shore. While these conditions may not be likely to occur, this situation should be considered in this statement.

4.3 8. We suggest that the final statement should include the expected sulfur content of the oil in this field.

2. State Agencies

The following section contains the comments of state agencies from whom review comments of the Draft Environmental Impact Statement were received. Where appropriate, the disposition of their comments is indicated and any unresolved issues are identified. Remarks of this nature precede the actual presentation of the review agency comments. In this way, we hope that the Department's responses to many of the issues raised can be easily located and oriented to the agency who brought the issue to our attention.

2. State Agencies

a. Florida

The State of Florida, Division of State Planning, submitted comments from several state agencies pertaining to a wide range of topics.

Disposition:

The majority of the comments have been incorporated into the final environmental impact statement.

3.1 These comments have been addressed in sections III.A.1 and 2., C., IV.A.1., and V.

5.1 This comment has been incorporated into the response to J. Jones comment 3.1.

5.2 Please refer to response to EPA comment 3.2.

6.1 These tracts are located approximately fifteen miles from the Florida Middle Ground and protective measures are not warranted.

8.1 The Bureau of Land Management is presently co-funding a special study with NOAA to develop a numerical model which will be capable of predicting the currents in the Gulf of Mexico for use in pollutant trajectory computation.

Several rig-monitoring and special studies, will soon be implemented to address the problems of chronic and short term impacts associated with platforms and pipelines. The first rig monitoring study will be initiated in November, 1975 in the South Texas OCS.

8.2 The tracts offered in this lease sale are approximately 50 miles offshore and current clean-up technology should prevent oil spills from coming onshore (see section IV.A).

10.1 This method of treatment of produced formation waters has been considered by the U. S. EPA (EPA, 1974 Draft Development Document For Effluent Limitations Standards For the Oil and Gas Extraction Point Source Category).

10.2 Agreement to the incorporation of the following stipulation into leases awarded as a result of Sale 41 was obtained by telephone on November 5, 1975 from Jim Barkuloo, U. S. Fish and Wildlife Service, Panama City, Florida and Joe Higham, U. S. Fish and Wildlife Service, Galveston, Texas. The wording of the stipulation was agreed to by telephone between the Geological Survey Gulf of Mexico office and the BLM New Orleans OCS office on November 5, 1975. Lease Stipulation for Sale 41.

> "If a pipeline is technically and economically feasible, no oil production will be transported by barge from this offshore lease to onshore facilities in the States of Florida, Mississippi and Alabama except in case of emergency or unusual circumstances. Determination as to emergency or other conditions and the technical and economic feasibility of pipeline installation will be made by the Area Oil and Gas Supervisor. For continuous production, transportation of oil by barge from this lease to onshore facilities in the States of Florida, Mississippi, and Alabama will not be permitted."

The stipulation will be incorporated into leases awarded on the following tracts: 73, 76 and 135.

11.1 As of October, 1975, the exploratory activity carried forward in the MAFLA area as a result of past leasing activities has resulted in very little impact on the Florida economy. Exploratory wells drilled in the area have, so far, not resulted in any known discoveries of oil or gas.

According to testimony presented by Mr. R. J. Robicheaux at a BLM public hearing in Mobile, Alabama on September 23-24,1975, three sites in Florida were used as support bases by operators engaged in exploration in the MAFLA area. Mr. Robicheaux a sales consultant for the Otis Engineering Corporation, a supplier of specialized equipment and services for the oil and gas industry, collected data from oil companies and service companies who were active in exploring the MAFLA leases. On the basis of his survey, Mr. Robicheaux noted that operating points for the oil companies included Port Manatee, Panama City, and Pensacola, Florida. The total land requirements in the three parts amounted to approximately 15 acres. Employment in onshore activity was provided for 83 persons, 44 transferred into the area and 39 from local communities.

These impacts involve only the exploration phase of operations, and if the exploration phase is successful and is followed by the development phase, the impacts may be different.

11.2 Reference was made to Sale 32 and to the estimated facilities that would be required if the hypothetical development scheme developed in that impact statement should materialize. The facilities required for Sale 41 could be, in part, met by incremental additions to facilities established for Sale 32. To some extent, the need for facilities of specific types cannot be estimated until potentially commercial dicoveries of oil and/or gas have been made.

12.1 Further discussion of the military ordnance disposal activities in the Gulf of Mexico appeared in the section entitled Military

Uses of the Continental Shelf (section II.G. 2b) in the draft impact statement. A discussion was included pointing out the possibility of potential hazards resulting from the emergency release of ordnance materials.

12.2 A discussion of energy conservation was included in section VII Alternatives to the Proposed Action.

12.3 These corrections have been incorporated into the Final EIS.

13.1 Please refer to response to comment 8.1.

14.1 Based on data obtained for these areas, only one tract (#92) required a special stipulation. This stipulation requires a geophysical survey for site selection for any activities and shunting of drill cuttings and mud if reefal formations are located. The closest tract offered to the Florida Big Bend area is 57 miles from shore.

Off the Florida coast, sixteen tracts have special stipulations which require geophysical surveys and shunting if reefal formations are detected. Also see response to 6.1.

18.1 Please refer to response to EPA comment 1.1.

No visual buffer zone policy has been articulated by BLM at this time; however all of the tracts offered for this lease sale are well beyond the visual range of the Florida shoreline.

20.1 See response to J. Jones comment 5.1.

20.2 Please refer to response to J. Jones comment 10.2.

20.3 These corrections have been made in the Final EIS.

21.1 The statistical probability of an OCS spill has not been determined due to undefined variables; but based on previous experience, such

an occurrence is not likely.

21.2 This correction has been made in section III.A.1.

21.3 The number of spills recorded on Table 81.1 in Section IV.A.3 for the period October, 1974 through February, 1975 indicates that 39 spills comprising 549 barrels of crude oil occurred. The description of seven of these spills includes five in which reference is made to crude oil, and the total volume of crude oil reported was 435 barrels.

21.4 See response to J. Jones comment 13.1.

21.5 Baseline and monitoring studies for reefs and banks in MAFLA (Florida Middle Grounds) and South Texas (topographical highs) will better define the indirect impact from drilling and production operations. Presently, we have special stipulations on over 50 tracts in the Gulf of Mexico around reefs or banks for protective measures.

21.6 The beneficial effects of exposed pipelines and production platforms are similar to those created by an artificial reef which increases the biota (snappers, groupers, etc.) associated with them. As stated in the DES, Dr. Thompson's study was directed towards bottom fish trawl fisheries (shrimp, industrial fish, etc.) which are not associated with artificial reefs. Therefore, we have clarified Dr. Thompson's statement.

22.1 Drilling muds are not generally discharged in bulk but cling to cuttings.

23.1 This is covered under USGS OCS operating order No. 7.

23.2 & 23.3 See response to J. Jones comment 13.1.

23.4 The U. S. EPA would be the permitting agency if this method of disposal is considered.

23.5 Please refer to section IV.D.

23.6 A uniform spill reporting system presently exists via an 800 telephone connection to the U. S. Coast Guard National Response Center.

23.7 & 23.8 See response to J. Jones comment 13.1.

24.1 We believe the USGS OCS Operating Orders issued are adequate for the day to day operations. In addition, these orders are being revised and updated.

As previously stated special stipulations for reefs and banks, and commercial fishing activities are included in DES.

24.2 The facilities required for Sale 32 and for Sale 41 have been set forth in the respective impact statements. Reference was made to the possibility of certain facilities jointly serving leases awarded in both sales. To some extent, the needs for these facilities will be dependent on available existing port space, tanker terminals, and the location of successful oil and gas discoveries that may be made on leases awarded in the two sales.

24.3 The BLM currently presents all pertinent information to the public concerning individual lease sales. The Environmental Impact Statements clearly elaborate on the expected impacts, stipulations, etc. that result from a sale proposal. The stipulations attached to the statements and lease agreements are not relaxed but are adhered to. Baseline studies are conducted prior to exploration

of leased tracts and always have state involvement. The results of these studies are available to any interested persons. Also, prior to allowing a permit for exploration, the U. S. Geological Survey consults with the U. S. Fish and Wildlife Service and Bureau of Land Management on each tract an application has been applied for to determine if any additional data have become available that may influence development. In all cases, the data presented in the impact statements have remained unchanged and have not resulted in significant new information. The volume and time frame of these transactions preclude notifying the public.

28.1 These corrections have been noted and will be included in the next printing of the visual graphic.

28.2 It is recognized that outdoor recreation is in many cases associated with the other resource values that were anlyzed. However, for the purposes of this analysis, only those tracts that received proximity values of 1.0 were considered potentially hazardous or disruptive to the individual categories. Resources and uses with proximity values of less than 1.0 are presented only to indicate relative distances from the tracts. Thusm these tracts do not reflect a high disruptive potential to the outdoor recreation resource.

29.1 The planning process of OCS petroleum development allows for pipeline management studies, environmental analysis records, and rig monitoring studies. These are coordinated with other federal and state interests.

STATE OF FLORIDA

Department of Administration

Division of State Planning

660 Apalachee Parkway - IBM Building

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32304

(904) 488-1115

R. G. Whittle, Jr.
STATE PLANNING DIRECTOR
(ACTING)

Reubin O'D. Ask
GOVERNOR

Lt. Gov. J. H. "Jim" Wi
SECRETARY OF ADMINISTRATI

October 13, 1975

Manager, New Orleans O.C.S. Office
Suite 3200
1001 Howard Avenue
New Orleans, Louisiana 70113

Dear Sir:

Functioning as the state planning and development clearinghouse contemplated in U. S. Office of Management and Budget Circular A-95, we have reviewed the following draft environmental impact statement:

Proposed 1976 Outer Continental Shelf Oil and Gas
General Lease Sale,Gulf of Mexico OCS Sale #41,
SAI #76-0414E

During our review we referred the environmental impact statement to the following agencies, which we identified as interested: Department of Commerce, Department of Community Affairs, Department of Environmental Regulation, Department of Legal Affairs, Department of Natural Resources, Department of State, Department of Transportation, and Game and Fresh Water Fish Commission. Agencies were requested to review the statement and comment on possible effects that actions contemplated could have on matters of their concern. Letters of comment on the statement are enclosed from the Department of Commerce, Department of Community Affairs, Department of Environmental Regulation, Department of Legal Affairs, Department of Natural Resources, Department of Transportation, and the Technical Review of the O.C.S. Sale #41, Department of Administration, Division of State Planning, James I. Jones, Special Projects Officer. The Game and Fresh Water Fish Commission reported no adverse comments, although they did express concern over the possible secondary impacts of oil production particularly within the coastal zone.

The clearinghouse has reviewed this draft statement and the comments thereon. We concur with the comments as presented by the state departments and the Technical Review as submitted by James I. Jones, Division of State Planning.

Manager, New Orleans O.C.S. Office
October 13, 1975
Page 2

In accordance with the Council on Environmental Quality guidelines concerning statement on proposed federal actions affecting the environment, as required by the National Environmental Policy Act of 1969, and U. S. Office of Management and Budget Circular A-95, this letter, with attachments, should be appended to the final environmental impact statement on this project. Comments regarding this statement and project contained herein or attached hereto should be addressed in the statement.

We request that you forward us copies of the final environmental impact statement prepared on this project.

Sincerely,

R. G. Whittle, Jr.

R. G. Whittle, Jr.
State Planning Director
(acting)

RGWjr:Kc

Enclosures

cc:

Mr. Thomas A. Harris	Mr. Harmon Shields	Mr. Robert Williams
Mr. William H. Ravenell	Mr. E. J. Trombetta	Mr. William P. White, Jr.
Mr. J. Landers	Dr. Tim Stuart	Mr. Walter Kolb
Mr. W. N. Lofroos	Mr. H. E. Wallace	

TECHNICAL REVIEW - DEIS/OCS SALE #41

James I. Jones, Special Projects Officer
Florida Division of State Planning

A Technical Review of the Draft Environmental Statement "Proposed 1976 Outer Continental Shelf Oil and Gas General Lease Sale Gulf of Mexico - OCS Sale No. 41," has been completed. A copy of the oral statement which was given at the DEIS Hearings in Mobile, Alabama, September 23, 1975 is attached. The oral statement addresses the more general aspects of the DEIS and expresses a number of Florida's concerns relative to OCS development and its anticipated impacts upon the State. This technical review addresses specific items from the DEIS within the following categories: drilling muds, drill cuttings, resuspension of sediments, reefs and corals, pipelines, chronic (sublethal) pollution, oil spills, injection of brines, barging and tanker transport, economic impacts, relationship of Sale #32 to Sale #41, multi-use of the OCS, conservation, and errata and mistakes. It discusses research needs which are identified within the DEIS, and recommends a number of stipulations or special precautions appropriate for elements of the exploration and development program.

Drilling Muds

3.1 The DEIS is unclear and inconsistent relative to the discharge and disposal of drilling mud. In some cases the impression is given that there will be no deliberate disposal of drilling mud; i.e., "since this mud could enter" (p. 360), "this mud may enter"

(p. 370), muds "may" be discharged (p. 431); while in other instances it indicates clearly that deliberate disposal will occur; i.e., "the discharge of drill cuttings and mud will produce" (p. 361), "any drilling mud which may contain toxic substances must be neutralized before it can be disposed of in the ocean" (p. 508), "the area to be effected from discharged drill mud and cuttings and pipeline burial cannot be quantified" (p. 553). There is no question that large quantities of drilling mud will be deliberately discharged during exploration and development drilling. There should be no implication, deliberate or otherwise, that this is not the case. On page 431 it states that "no detailed studies have been made on the manner in which drilling mud chemicals and drill cuttings may contribute to pollution in the marine environment." While this statement may be substantially correct, it is appropriate to note that a number of the elements contained within drilling mud are discussed in the Environment Protection Agency publication, Water Quality Criteria 1972 (EPA-R3-73-033-March 1973). For example, Barium, the primary (most abundant) element found in the drilling mud is discussed (p. 244) and the statement is made that "In view of the widespread use of barium, the effects of low doses of this element and its compounds on marine organisms under different environmental conditions should be determined. Disposal of barium-containing wastes into waters when precipitates could affect

rooted aquatics and benthic invertebrates should be avoided." This, and other statements concerning EPA's evaluation of elements contained within the drilling mud and brines, should be included within the DEIS. A stipulation forbidding the dumping or disposal of barium in areas of rooted aquatics or benthic invertebrates should be made a condition of the sale. In less sensitive areas, or those of low productivity, but which abut or are near regions of sensitivity or high productivity, a requirement should be established to shunt the drilling mud and cuttings to near the seafloor before dispersal.

Drill Cuttings

5.1 The statement is made that (p. 368) "Deposition of 695 tons of cuttings during drilling of each exploratory well will disrupt local benthic environments. All non-mobile benthic forms in the affected area will be smothered." Appropriate efforts need be made to lessen this impact on the benthos. Shunting of the drill cuttings to an area near the bottom before dispersal could localize this affect, and should be considered in areas of moderate to high infaunal non-motile populations.

Resuspension of Sediments

5.2 The problem of resuspension of sediments during pipeline laying operations is discussed in a number of places in the DEIS (pp. 362,372,381,430,558). The probability of reintro-

ducing polluting materials such as toxic heavy metals and hydrocarbon pesticides is high in certain polluted bays and estuaries along the Florida coast. It is imperative that pipeline corridors be established in such a way as to avoid these areas. In some cases these areas are readily identified (Escambia Bay, St. Joseph Bay, Upper Tampa Bay) while in others which are less dramatic or apparent it will be necessary to evaluate outfall areas of polluted bays or rivers to determine optimum routing of pipelines to shore. Long-term environmental impacts may result from pollutant resuspension into the water column from dredging or jetting activities. Where there is this possibility, mitigating measures must be introduced to assure an adequate safety level relative to the redistribution of these toxic sediments. In some cases it may be necessary to require booms, screens, dikes or other mechanisms to establish settling areas to avoid wide dispersal of the pollutants. Such situations are most likely to occur in shallow water, in-shore, where State regulations will govern the activity. The problem can be best resolved in most cases by choosing pipeline routes which will avoid areas of toxic sediments.

Reefs, Corals and Fishing Banks

6.1 It is noted (pp. 126-127) that special stipulations are proposed for coral and other growths attractive to fish. Areas are listed (pp. 390, 496) which contain known reefs and fishing banks. These areas do not include those near the Florida

Middle Ground (Tracts 81-84) which <u>may</u> also contain such features. If it is determined by survey or other means that areas other than those recommended for the stipulations (nos. 2 and 3, Sec. LV.D) are also reefoid or contain fishing banks, these areas must also be included within the stipulations. Since the detailed bathymetry and character of the bottom is unknown or poorly known for much of the proposed lease area, the opportunity to apply special stipulations such as those cited above to any area containing reef structures or fishing grounds must be provided.

<u>Pipelines</u>

7.1 The DEIS states (p. 398) that production from this sale proposal will be connected to existing facilities and that it is estimated that the probability of pipelines coming ashore as a result of this sale is remote. This is incorrect for the Eastern Gulf of Mexico as is noted later (p. 340). The earlier statement (p. 398) should also note this. Pipeline corridors should be stipulated for this sale, as they were for Sale #32, for the MAFLA area. Reference is made (p. 533) to a recent Memorandum of Understanding between the Bureau of Land Management and the Geological Survey, for OCS pipelines, whose purose is to "clearly define the administrative and operational roles of the Bureau of Land Management and the U. S. Geological Survey relating to pipelines on the OCS, to provide consistent and

standardized procedures, and to minimize or eliminate dual and overlapping functions." Although the major points of this memorandum are outlined, a copy of it in its entirety should be included in the appendix of the DEIS.

Chronic (sublethal) Pollution

8.1 Little is currently known of the effects of chronic low-level pollution. It is noted that (p. 565) chronic low-level pollution from oil and toxic chemicals will have adverse impacts in certain areas, and that "it is not possible to quantify this and estimate the short or long term affects or even the location that this may occur." Additionally (p. 367) the statement is made that chronic low-level discharge effects include direct lethality, reduction in photosynthetic efficiency, interference with chemical communication and general physiological stress, and that the magnitude of this as it affects the total marine ecosystem "is still in the unknown category." It is apparent that all possible effort should be made to determine and evaluate these effects. This is a fundamental and critical research need.

Oil Spills

8.2 The massive oil spill is the most devastating, obvious short-term impact associated with OCS development and exploration. A great deal of the Florida coastline is highly susceptible to massive damage by this means. A potential for major disaster exists, as is indicated by the fact (p. 442) that 293,250 acres will be offered west of the Tampa Bay area, and that although

most of the time winds and currents would keep a spill from coming ashore there, "winds may blow from any point of the compass and especially during frontal passage could rapidly push an oil spill toward adjacent beaches." The "Big Bend" area of the Florida coast, approximately between Apalachicola Bay and Cedar Key, is one of the most productive areas in the whole Gulf of Mexico and serves as the nursery ground for many of the sport and commercial shellfish and finfish found in the Gulf. It is also an area characterized by a low energy shoreline. The DEIS addresses this situation (p. 390) ..."In summary, if oil were to be deposited on the moderate or low energy shoreline of the Gulf of Mexico, there would probably be a substantial kill of infauna. Removal of oil by natural means would probably be very slow and would require redistribution of the sand by storm tides and high-energy storm surf. Recovery rates would range from months to years depending on reproduction cycles, recolonization and extend (sic) of contamination." As previously stated (DEIS Comments for Sale #32 by this author), this highly productive area of the Gulf of Mexico must not be subjected to oil exploration or production. Areas bordering or near this region should have stipulations requiring special care to prevent accidental or other introduction of petroleum into it. A catastrophic event of long-term duration would be precipitated by an oil spill in this area.

Injection of Brines

10.1 The negative impact of formation water (brines) which represent "a potential significant hazard which could degrade the water quality and which may have adverse affects on the marine biota" is noted (p. 433). Further discussion indicates that these effects could be almost totally eliminated by injection of these waters back into the geological formation from which they came. Although this may not be practical in all cases, it should be encouraged or required where it can be. A routine requirement to inject produced formation water back into the producing formation, both to enhance crude oil or gas recovery and as a means of eliminating the negative environmental impact of introducing these waters into healthy marine ecosystems, should be considered.

Barging, Tanker Transport

10.2 The assumption is made (p. 457) "that pipelines would be installed early in the development program, and would be functional by the time of production, eliminating the need for this barging requirement." and "because of the anticipated production characteristics, and weather constraints, no barging from production sites to onshore receiving facilities is anticipated." As in the MAFLA (#32) Sale, there should be a clear prohibition of barging or transporting oil by tanker from the production area to shore. All oil transportation in the production phase must be by pipeline.

Economic Impacts

11.1 Minimal economic impacts are anticipated for Florida because (p. 482) "it appears probable that oil and gas produced as a result of this sale will provide for the continuation of existing patterns of employment in those areas adjacent to the Gulf of Mexico where the industrial infrastructure related to the oil and gas industry is established." It also states that additional facilities such as refineries, crude oil, and natural gas gathering and transportation systems and petrochemical plants will not result from this sale. From these statements it appears that minimal economic impact will affect Florida, at the scale of major facilities. In many smaller communities of Florida, however, even small-scale activities related to the OCS development may have a major impact upon specific sites and localities. These areas must be determined, and the amount and type of impact evaluated, to ameliorate as many negative aspects as possible, both economic and social.

Relationship of Sale #32 to Sale #41

11.2 The relationship of the impact of this sale (#41) to the MAFLA sale (#32) must be considered when evaluating the total impact of OCS development to the State. There is a great deal of overlap in the facilities required, investigations which need be done, impacts of all types, etc. There is a possibility of 563,000 barrels of oil per day being produced from these two sales. Any comprehensive impact evaluation must take both sales into account (pp. 465-466 of the DEIS). It is noted

(p. 568) that there will probably not be an expansion of on-shore facilities as a result of this sale, but this disregards the impacts of Sale #32.

Multi-Use of the OCS

12.1 Page 439 of the DEIS notes that continued use of shallow nearshore portions of the continental shelf for military ord-nance disposal severely limits the potential uses of these areas for other purposes, and directly opposes the multiple use concept of the OCS. This question must be addressed, and mechanisms established to open as much of the OCS area as possible to multi-use activities.

Conservation

12.2 It has been repeatedly shown by studies conducted by the Federal Energy Office, Council on Environmental Quality, Bureau of Land Management and others, that the most effective, immediate redistribution of petroleum for priority activities may be achieved through rigid conservation measures. These measures need not be so stringent as to have overwhelming effects on present life-styles. Any program which is endorsed MUST have energy conservation as a major aspect of it.

Errata and Mistakes

12.3 The following appear to be errors: Page 371, line 8 ... "and dispersion rate of drilling and in water column."; page 381-382, "(4) A large oil spill with a maximum amount of sinking

oil would be the most detrimental to subtidal benthos. Since the literature indicates oil spills cause a range from extensive destruction to slight or undeterminable amounts, we must conclude that some destruction will occur which could be covered as a result of a massive oil spill."; page 438, second line from bottom, ..."and ordnances have been jettisoned as far southward as Choctawhatchee Bay." (Should it be "northward" instead of "southward"?)

Identified Research Needs

13.1 Although numerous aspects of information are deemed less than adequately known throughout the DEIS, the following are particularly noteworthy.

The many unknowns relative to chronic, low-level pollution (p. 565).
Unknown effects of uptake of water soluble aromatics not removed in the separation process (p. 363).
There is not enough available information to define what, if any, significant threat there may be to any species relative to egg or larval mortality or spawning ground oiling (p. 384).
That sublethal effects may be an important impact of oil production, and that the severity of these impacts is uncertain (p. 384).
That biomagnification (bioaccumulation) might occur in body lipids, and that the pathways, amount of retention, degree of concentration and possible overall effects are not well known or understood (p. 384-385).
That the carcinogenic aspect of introduction of petroleum into the food chain of humans is uncertain and the potential unknown (p. 384-385).

In addition to these major, identified problems, those of evaluation of environmental, social and economic impacts within the State Territorial Sea, Bays and Estuaries, Coastal Zone and Impacted Uplands are of critical importance to states bordering

OCS development lands, and need be addressed with equal or greater urgency than those problems of the Federal OCS area.

Recommended Stipulations and Special Precautions

14.1 A number of recommended stipulations and special precautions have been cited above. These will be repeated here, and additions made as appropriate. These are general recommendations for stipulations, and are not intended to provide specific wording.

Tracts 81-84 and 89-94 should be considered for special stipulations due to the probability of these being areas of high productivity or special interest. The biological requirements of the Notice issued 12 August 1974 explaining and detailing minimum biological survey requirements for the Florida Middle Ground are applicable in these cases and should be required and stipulated.

The stipulations proposed for Flower Garden reefs and fishing banks (stipulations nos. 2 and 3, Sec. IV.D) should be applied to any areas which are found to contain reefoid structures or to be of high productivity or special fragility. This would include the areas adjacent to the "nursery ground" area of Florida's Big Bend.

Florida's Big Bend area, for reasons stated above, should not be opened for leasing.

Special requirements for shunting or otherwise disposing of drilling mud, other than dumping, should be considered for biologically sensitive areas, determined either before or after baseline evaluation.

No barging ashore of petroleum from production drilling should be allowed.

Pipelines should not be laid in areas where resuspension of toxic sediments may present environmental hazards. In the event that such sediments are disturbed, containment requirements must be met.

Pipeline corridors must be stipulated for this sale, as they were for Sale #32.

It should be noted that 70% of the "oil prone tracts" with "benthic assemblages that could be impacted from spilled oil" are off the Florida coast. Additionally, 32 of 59 tracts off Florida have <u>both</u> a Relatively High Hazard Potential and a Relatively High Disruption Potential, as defined in the DEIS. For these and other reasons, particular care must be taken in these areas, both off the Florida coast and elsewhere.

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...rl M. Starnes
...E PLANNING DIRECTOR

Reubin O'D. Ask...
GOVERNOR

Lt. Gov. J. H. "Jim" Will...
SECRETARY OF ADMINISTRA...

SEP 29 1975

RECEIVED

SAI NO.

TO: Mr. Ed Trombetta, Secretary
Department of Commerce
510 Collins Building
Tallahassee, Florida 32304

DATE: September 16, 1975

DUE DATE: October 2, 1975

FROM: Bureau of Intergovernmental Relations

SUBJECT: SAI: 76-0414E

Please review and comment to us on the above draft environmental impact statement, copy attached. In reviewing the statement, you should consider possible effects that actions contemplated could have on matters of concern to your agency.

If you feel that a conference is needed for discussion of the project or resolution of conflicts, or if you have questions concerning the statement, please call Mr. Walt Kolb at (904) 488-2401. Please check the appropriate box below, attach any comments on your agency's stationery and return to BIGR or telephone "no adverse comments" by the above due date.

On that date, we intend to consider all review comments received and develop a state position on the project. In both telephone and written correspondence please refer to the above SAI number.

Sincerely,

Ed Maroney

Chief
Bureau of Intergovernmental Relations

Enclosure
****

TO: Bureau of Intergovernmental Relations

FROM: DIVISION OF ECONOMIC DEVELOPMENT

SUBJECT: DEIS Review and Comments

✓ ~~No~~ Comments

Comments Attached

Reviewing Agency: DIVISION OF ECONOMIC DEVELOPMENT

Signature: [signature]

Date: 9/26/75

TITLE: CHIEF, MARKETING DEVELOPMENT

Earl M. Starnes
STATE PLANNING DIRECTOR

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Reubin O'D. A
GOVERNOR
Lt. Gov. J. H. "Jim" W
[redacted]
SECRETARY OF ADMINIS

OCT 13 1975
RECEIVED
SAI NO. ______

RECEIVED
SEP 22 1975
DIVISION OF
TECHNICAL ASSISTANCE
DEPT. OF COMMUNITY AFFAIRS
OFFICE OF THE SECRETARY

TO: Mr. William H. Ravenell, Secretary
Department of Community Affairs
Howard Building
2571 Executive Center Circle, E.
Tallahassee, Florida 32301

DATE: September 16, 19

DUE DATE: October 2, 1975

FROM: Bureau of Intergovernmental Relations

SUBJECT: SAI: 76-0414E

Please review and comment to us on the above draft environmental impact statement, copy attached. In reviewing the statement, you should consider possible effects that actions contemplated could have on matters of concern to your agency.

If you feel that a conference is needed for discussion of the project or resolution of conflicts, or if you have questions concerning the statement, please call Mr. Walt Kolb at (904) 488-2401. Please check the appropriate box below, attach any comments on your agency's stationery and return to BIGR or telephone "no adverse comments" by the above due date.

On that date, we intend to consider all review comments received and develop a state position on the project. In both telephone and written correspondence please refer to the above SAI number.

Sincerely,

Ed Moroney

Chief
Bureau of Intergovernmental Relations

Enclosure

****

RECEIVED

TO: Bureau of Intergovernmental Relations

FROM: COMMUNITY AFFAIRS

SUBJECT: DEIS Review and Comments

No Comments

Comments Attached

Reviewing Agency:

Signature: H. Schmertmann

Date: 10/9

TITLE: Bur. Chief

745

Originator Department of the Interior Subject DEIS

SAI # 76-0414E Reviewer Jim Sayes Date 10/8/

- -

Staff has reviewed the Draft Environmental Impact Statement for the Lease Sale of Outer Continental Shelf Lands for 1976 (SAI: 76-0414E). We wish to support the oral testimony presented by Florida's representative at the public hearing in Mobile, Alabama, September 23, 1975.

As the state agency concerned about Community Affairs, we contemplate the sale of the leases, drilling and if successful, oil and gas production in a rather ambivalent manner. Florida's major contributor to its economy is the Tourism industry. Without gasoline and oil the industry will suffer considerably. On the other hand unsightly drilling rigs, oil spills, etc. could affect the tourist's desire to come to Florida also. Oil spills or some other introduction of toxic materials into the waters of the Gulf and possibly into the marsh areas of the Big Bend could have disastrous effect on the sports and commercial fishing interests of the area.

We recognize that the royalties from the off-shore oil production are a major contributor to the U.S. Land and Water Conservation Fund which Florida, and the nation, has used to purchase outstanding outdoor recreation lands and facilities. A cutback on these monies could have adverse effect on the program. On the other hand oil spills, etc., could ruin sensitive and aesthetic recreation areas.

While this proposal will not make a direct major effect on the Florida economy, i.e., large production plants, etc., the day to day operation of the drilling rigs, etc. could have some direct effects on the economy of some of the small rural towns of the state. Impact of this needs further study.

We would recommend thorough study of the selection of lands to be leased for the potential impact on Florida. Consideration of buffer zones to eliminate negative aesthetic impact on the tourist beaches and waters of the state is suggested.

It has been noted in the past the highly sophisticated efforts of NASA to eliminate pollution and contamination in the space explorations. Possibly similar kinds of restrictions could be placed on the OCS explorations to eliminate as much as possible adverse effects on Florida's natural resources.

STATE OF FLORIDA

DEPARTMENT OF ENVIRONMENTAL REGULATION

2562 EXECUTIVE CENTER CIRCLE, EAST
MONTGOMERY BUILDING
TALLAHASSEE, FLORIDA 32301

REUBIN O'D. ASKEW
GOVERNOR

JOSEPH W. LANDERS, JR
SECRETARY

October 8, 1975

Comprehensive - Outer
Continental Shelf - General
Offshore Leasing, MAFLA-OCS

Mr. Walt Kolb
DOA/DSP
IBM Building
660 Apalachee Parkway
Tallahassee, Florida 32304

Dear Walt:

We would like to take this opportunity to comment on the OCS Sale No. 41. After reviewing Dr. Jones' technical review of the subject, we find that our technical comments include the same specifics as presented in his document. Based on these similarities, we concur with the information and interpretation of Dr. Jones.

Thank you for the opportunity of reviewing and participating in formulating a State response on this matter.

Sincerely,

Patrick M. McCaffrey, for
Tim S. Stuart, Ph.D.
Chief
Bureau of Water Quality

TSS:dpm

cc: Mr. John A. Redmond
Mr. Patrick M. McCaffrey
Dr. Frank X. Phillips

STATE OF FLORIDA
DEPARTMENT OF ENVIRONMENTAL REGULATION
2562 EXECUTIVE CENTER CIRCLE, EAST
MONTGOMERY BUILDING
TALLAHASSEE, FLORIDA 32301

JOSEPH W. LANDERS, JR
SECRETARY

October 10, 1975

Mr. Walter Kolb
Division of State Planning
Department of Administration
IBM Building, Apalachee Parkway
Tallahassee, Florida 32304

Dear Mr. Kolb:

D.E.S.; O.C.S. Lease Sale 41

Thank you for the opportunity to review this draft statement. Dr. Jones has done an excellent technical review and I find that my notes coincide with his findings to a great extent. However, I believe some areas bear re-emphasis. Hence, the following comments:

1. Drilling Muds.

20.1 (a) Dr. Jones has documented the inconsistencies of the D.E.S. which contains, in some portions, indication that drilling muds are to be discharged only when drill cuttings are incompletely washed. Later contrary statements indicate that such discharges are to be a normal occurrence. Impact is said to be unquantifiable.

20.2 (b) The discussion of barging drilling muds for disposal away from sensitive areas, as described at page 541, suggests that impacts not previously considered may occur. Such barging for disposal might also fall within the provisions of the Marine Protection, Research and Sanctuaries Act (181).

2. Oil Spills.

20.3 The D.E.S. is notably inconsistent in its discussion of oil spills and other "unpredictable" incidents

generated by O.C.S. activities.

21.1 (a) There is frequent reference to an inability to estimate the probability of oil spills, etc. resulting from O.C.S. operations (363, 367, 425, 426). However, with nearly equal frequency, statements are made that the chances of certain incidents such as spills and blowout fires are "minimal" (426) or "low" (less than one per 1,000 wells drilled) (503).

21.2 (b) Presentation of data regarding reported oil spills and slicks presents a jumbled melange of differing terms, differing meanings, differing reporting periods and differing sources. "Major oil spill" can apparently mean either those greater than 100,000 gallons (363) or greater than 50 barrels (366).

21.3 The D.E.S. reports some seven "significant" spills of greater than 15 barrels from October 1, 1974 to February 25, 1975 (512). And yet, a table (520) shows thirty-nine slicks or spills in the same period which comprise a lesser total amount of oil.

21.4 (c) The D.E.S. contains considerable discussion regarding impacts of oil spills but generally refers to lack of information in the area. At the same time it includes no discussion of any effort by the federal government to increase knowledge regarding impacts visited upon the resources critical to neighboring states.

3. Fishery Resources.

21.5 (a) The D.E.S. states that the potential for long term, indirect impact from drilling and production operations on reefs and banks is insufficiently known to allow prediction (390).

21.6 (b) The D.E.S. concludes that placement of exposed pipelines and production platforms is beneficial (386) and yet at the same page reports that Dr. Thompson found no evidence of either harmful or beneficial effects.

4. Consideration of Cumulative Impact.

The D.E.S. consistently and inaccurately views this lease sale as divorced from other O.C.S. activities in its consideration of potential impacts. This position contains an innate inconsistency since impacts are viewed as being minimized because of facilities expected to be generated by other sales. This approach is particularly myopic when applied to leases in the Eastern Gulf. Tracts offered in this area could potentially double leases in the area. Hence, this sale should be viewed as potentially doubling the likelihood of activities and facilities in the area along with their potential impacts.

5. Post-Lease Information.

The D.E.S. indicates that a continuing process of data acquisition may have an effect on O.C.S. related activities after the actual sale. It indicates that such information as that acquired from baseline studies and monitoring of environmental impact (544) and acquisition of high-resolution geophysical data may be used to impose more stringent operation requirements (544) or to grant waivers from previously imposed controls (545, 548).

No method is mentioned by which interested states and the public will be kept informed of developments bearing upon the extent of actual or expected impact of O.C.S. activities.

RECOMMENDATIONS:

22.1 1. (a) i. Prohibit the direct discharge of drilling muds without a case-by-case demonstration and a finding by B.L.M. that reuse of muds or land disposal are not feasible.

23.1 ii. Impose stringent standards designed to minimize discharge of drilling muds with incompletely washed drill cuttings.

23.2 iii. Implement detailed studies designed to quantify the short term and chronic impact of drilling muds wherever direct discharge is allowed.

23.3 iv. Implement representative studies designed to quantify short term and chronic impact of drill cuttings where direct discharge of muds is not allowed.

23.4 (b) Describe in F.E.S. the relationship of potential barging and disposal of drilling muds (541) with ocean dumping permit requirements and include a description of any proposed method of keeping concerned states and the public informed of any such activities if proposed.

23.5 2. (a) Implement studies designed to develop methods of analysis and prediction of oil spills from O.C.S. related activities.

23.6 (b) Implement a uniform reporting system in cooperation with other concerned federal agencies employing uniform terminology and reporting periods. Such a system should be designed so as to produce tabulations of actuarial experience with spills. Such tabulations should reveal spills attributable to drilling, production, transportation and processing.

23.7 (c) Implement studies on chronic (413) and short term impacts of oil spills, some of which are causally related to federal revenue producing lease sales.

23.8 3. (a) Implement studies on chronic and short term impacts of platforms and pipelines on fishery resources to fill the lack of information regarding effects of placement and discharges of facilities.

Mr. Walter Kolb
Page Five
October 10, 1975

24.1 (b) Require stringent controls on O.C.S. activities in known areas of high productivity.

24.2 4. Evaluate, in the F.E.S., the total impact of incremental sales in the Eastern Gulf from all related activities such as drilling, production, pipelines, processing and waterborne transportation.

24.3 5. Provide for a method by which interested states, etc., will be informed of significant new information regarding expected impacts as discussed in D.E.S. and any proposed waiver of environmental controls on O.C.S. activities.

I hope that these comments are of some aid in your preparation of the state's response to the D.E.S.

Sincerely,

William P. White, Jr.
Attorney for the Department

WPW/ot

660 Apalachee Parkway · IBM Building

TALLAHASSEE

32304

(904) 488-2371

Earl M. Starnes
STATE PLANNING DIRECTOR

Reubin O'D. A
GOVERNOR

Lt. Gov. J. H. "Jim" W
[redacted]
SECRETARY OF ADMINI

SEP 11 '75

TO: Department of Legal Affairs
The Capitol
Tallahassee, Florida 32304

DATE: 9.10.7

DUE DATE: 9.26.75

FROM: Bureau of Intergovernmental Relations

SUBJECT: SAI: 76.0414E

Please review and comment to us on the above draft environmental impact statement, copy attached. In reviewing the statement, you should consider possible effects that actions contemplated could have on matters of concern to your agency.

If you feel that a conference is needed for discussion of the project or resolution of conflicts, or if you have questions concerning the statement, please call Mr. Walt Kolb at (904) 488-2401. Please check the appropriate box below, attach any comments on your agency's stationery and return to BIGR or telephone "no adverse comments" by the above due date.

On that date, we intend to consider all review comments received and develop a state position on the project. In both telephone and written correspondence please refer to the above SAI number.

Sincerely,

Chief
Bureau of Intergovernmental Relations

Enclosure

****

TO: Bureau of Intergovernmental Relations

FROM:

SUBJECT: DEIS Review and Comments

~~No Comments~~

Comments Attached

Reviewing Agency: Department of Legal Affairs

Signature: Thomas A. Harris

Date: Oct 10, 197

TITLE: Assistant Attorney General

OCT 13 1975
RECEIVED
SAI NO.

STATE OF FLORIDA
DEPARTMENT OF LEGAL AFFAIRS
OFFICE OF THE ATTORNEY GENERAL
THE CAPITOL
TALLAHASSEE, FLORIDA 32304

ROBERT L. SHEVIN
Attorney General

Civil Division
725 South Calhoun Street
Bloxham Building
Tallahassee, Florida 32304

October 10, 1975

Mr. Ed Moroney, Chief
Bureau of Intergovernmental Relations
Department of Administration
660 Apalachee Parkway, IBM Building
Tallahassee, Florida 32304

Dear Mr. Moroney:

I have studied the Draft Environmental Impact Statement concerning OSC Sale No. 41. I have also read the comments on the statement made by Dr. Jones of the Division of State Planning. The Department of Legal Affairs concurs in and adopts the comments of Dr. Jones and has no other comment to add.

Sincerely,

ROBERT L. SHEVIN
Attorney General

Thomas A. Harris
THOMAS A. HARRIS
Assistant Attorney General

TAH/cr

cc: Mr. Walt Kolb

Department of Administration

Division of State Planning

660 Apalachee Parkway · IBM Building

TALLAHASSEE

32304

(904) 488-2371

Earl M. Starnes
STATE PLANNING DIRECTOR

Reubin O'D. Askew
GOVERNOR

[illegible]
SECRETARY OF ADMINISTRATION

Bureau of Intergovernmental Relations
SEP 29 1975
RECEIVED
SAI NO. ______

TO: Mr. Harmon Shields, Ex. Dir.
Dept. of Natural Resources
Crown Building
Tallahassee, Florida 32304

RECEIVED
SEP 11 1975
Executive Director
Department of Natural Resources

DATE: 9-10-75

DUE DATE: 9-26-75

FROM: Bureau of Intergovernmental Relations

SUBJECT: SAI: 76-0414E

Please review and comment to us on the above draft environmental impact statement, copy attached. In reviewing the statement, you should consider possible effects that actions contemplated could have on matters of concern to your agency.

If you feel that a conference is needed for discussion of the project or resolution of conflicts, or if you have questions concerning the statement, please call Mr. Walt Kolb at (904) 488-2401. Please check the appropriate box below, attach any comments on your agency's stationery and return to BIGR or telephone "no adverse comments" by the above due date.

On that date, we intend to consider all review comments received and develop a state position on the project. In both telephone and written correspondence please refer to the above SAI number.

Sincerely,

Ed Maroney

Chief
Bureau of Intergovernmental Relations

Enclosure

****

TO: Bureau of Intergovernmental Relations

FROM: Department of Natural Resources

SUBJECT: DEIS Review and Comments

___ No Comments

_X_ Comments Attached

Reviewing Agency: Department of Natural Resources

Signature: James B. Smith 755 Date: 9/26/75

TITLE: Administrative Assistant

State of Florida

DEPARTMENT OF NATURAL RESOURCES

HARMON W. SHIELDS
Executive Director

CROWN BUILDING / 202 BLOUNT STREET / TALLAHASSEE 32304

Governor
BRUCE A. SMATHERS
Secretary of State
ROBERT L. SHEVIN
Attorney General
GERALD A. LEWIS
Comptroller
PHILIP F. ASHLER
Treasurer
DOYLE CONNER
Commissioner of Agriculture
RALPH D. TURLINGTON
Commissioner of Education

September 26, 1975

Mr. Edgar E. Maroney, Chief
Bureau of Intergovernmental Relations
Division of State Planning
660 Apalachee Parkway, IBM Building
Tallahassee, Florida 32304

Dear Mr. Maroney:

Reference is made to your memorandum of September 10, 1975, pertaining to SAI 76-0414E -- Draft Environmental Statement on the Proposed 1976 Outer Continental Shelf, Oil and Gas General Lease Sale, Gulf of Mexico.

Pursuant to your request the Department staff has reviewed the Draft Environmental Statement and our Division of Resource Management indicated that they had no adverse comments. Our Division of Recreation and Parks and Division of Marine Resources provides comments as follows:

Division of Recreation and Parks

28.1 "In the interest of accuracy, the Draft Environmental Statement should include the following tracts administered by the Florida Division of Recreation and Parks: Waccasassa Bay State Preserve in Levy County (24,010 acres), Honeymoon Island State Recreation Area in Hillsborough County (114 acres), Weedon Island State Preserve in Pinellas County (592 acres), and Sanibel Island State Botanical Site in Lee County (186 acres).

28.2 The proximity analysis, if valid, is a useful tool for evaluating impacts. This analysis indicated that 36 of the 60 tracts on the Florida continental shelf present some hazard or disruption potential. None of these

DIVISIONS / ADMINISTRATIVE SERVICES • LAW ENFORCEMENT • MARINE RESOURCES
RECREATION AND PARKS • RESOURCE MANAGEMENT

are listed as disruptive to outdoor recreation; however, a number are listed as potentially hazardous to reef communities, and a few are listed as having some potential hazard to beaches and shorelines and to inter-tidal areas. Disruption of these areas does have implications for outdoor recreation.

In sum, we urge that extreme caution be used on those tracts that offer some threat to Florida's coastal ecosystems. The importance of the State's coastline cannot be overemphasized."

Division of Marine Resources

"Based on a very quick scanning of the volumes, it would appear that it refers to the sale not to the actual drilling sites or pipeline corridors. Thus, I would hope that once these actual drilling sites and pipeline corridors are proposed, further impact statements would be required and sufficient time allowed for their review so that the statements could be passed through the appropriate people at the St. Petersburg Marine Research Laboratory.

In lie of the answers to the above questions, I would make the following comments concerning offshore drilling. Probably the most critical concerns are the disposal of the drilling muds and cuttings, and the hydraulic dredging and location of pipeline corridors. Depending upon the areas in which drilling occurs, these could both be extremely significant to the marine resources. For example, drilling on the middle grounds where reef communities are extremely important and realizing that many species of corals require certain symbiotic algae which are dependent upon sunlight for good health, an increase in turbidity from drillings and cuttings would have extremely serious effects. My suggestions would be to retain all drilling muds and

Mr. Edgar E. Maroney
Page Three
September 26, 1975

cuttings and barge these to suitable upland disposal sites or to approved offshore disposal areas well beyond the Continental Shelf. The latter would also require special methods. These will probably be considered once actual drilling locations are established."

Sincerely,

James G. Smith
James G. Smith
Administrative Assistant

JGS:rt

Department of Administration

Division of State Planning

660 Apalachee Parkway - IBM Building

TALLAHASSEE

32304

(904) 488-2371

Earl M. Starnes
STATE PLANNING DIRECTOR

Reubin O'D.
GOVERNOR

Lt. Gov. J. H. "Jim"
[redacted]
SECRETARY OF ADMIN

TO: Mr. W. N. Lofroos, Chief
Department of Transportation
605 Suwannee Street
Tallahassee, Florida 32304

DATE: September 16,

DUE DATE: October 2, 197

FROM: Bureau of Intergovernmental Relations

SUBJECT: SAI: 76-0414E

Please review and comment to us on the above draft environmental impact statement, copy attached. In reviewing the statement, you should consider possib effects that actions contemplated could have on matters of concern to your agency

If you feel that a conference is needed for discussion of the project or resolution of conflicts, or if you have questions concerning the statement, please call Mr. Walt Kolb at (904) 488-2401. Please check the appropriate box below, attach any comments on your agency's stationery and return to BIGR or telephone "no adverse comments" by the above due date.

On that date, we intend to consider all review comments received and develop a state position on the project. In both telephone and written correspondence please refer to the above SAI number.

Sincerely,

Ed Maroney

Chief
Bureau of Intergovernmental Relations

Enclosure

****

TO: Bureau of Intergovernmental Relations

FROM: W. N. Lofroos, P.E., Chief, Bureau of Planning

SUBJECT: DEIS Review and Comments

XXX No Comments

Comments Attached

Reviewing Agency:

Signature: [signature]

Date: 9/26/75

759

TITLE: Administrator, Systems Planning

2. State Agencies

b. Alabama

The State of Alabama, Alabama Development Office reviewed the Draft Environmental Impact Statement (OCS Lease Sale No. 41) and no comments were offered.

George C. Wallace
Governor

STATE OF ALABAMA

ALABAMA DEVELOPMENT OFFICE

R.C. "Red" Bamberg
Director

W.M. "Bill" Rushton
Assistant Director

October 22, 1975

TO: Mr. Curt Berkland, Director
Bureau of Land Management
U. S. Department of the Interior
Washington, D. C.

Michael R. Amos

FROM: Michael R. Amos
State Clearinghouse
State Planning Division

SUBJECT: DRAFT ENVIRONMENTAL IMPACT STATEMENT

Applicant: U. S. Department of the Interior

Project: Draft Environmental Impact Statement for the 1976 Outer Continental Shelf Oil and Gas General Lease Sale, Gulf of Mexico

State Clearinghouse Control Number: ADO-025-75

The Draft Environmental Impact Statement for the above project has been reviewed by the appropriate State agencies in accordance with Office of Management and Budget Circular A-95, Revised.

The Environmental Impact Statement on this project appears to be in order. No comments are offered.

Please contact us if we may be of further assistance. Correspondence regarding this proposal should refer to the assigned Clearinghouse Number.

A-95/06

Agencies contacted for comment:
- South Alabama Regional Planning Commission
- Attorney General
- Conservation and Natural Resources
- Environmental Health Administration
- Coastal Zone Management-Hyde
- ADO - Wallace

AMERICAN REVOLUTION BICENTENNIAL 1776-1976

STATE OFFICE BUILDING • MONTGOMERY, ALABAMA 36104 • (205) 269-1831

2. State Agencies

c. Louisiana

The State of Louisiana, Commission on Intergovernmental Relations reviewed the Draft Environmental Impact Statement (OCS Lease Sale No. 41) and no adverse comments were offered.

STATE OF LOUISIANA

COMMISSION ON INTERGOVERNMENTAL RELATIONS

EDWIN EDWARDS
GOVERNOR

SENATOR MICHAEL H. O KEEFE
CHAIRMAN

LEON TARVER
EXECUTIVE DIRECTOR

P. O. BOX 44455
BATON ROUGE, LOUISIANA 70804
389-5664

October 27, 1975

Director
Bureau of Land Management
U. S. Department of the Interior
Gulf of Mexico
Outer Continental Shelf Office
Suite 3200, Plaza Tower
1001 Howard Avenue
New Orleans, La. 70113

Dear Sir:

As per your request, this is to confirm that we have received no adverse comments pertaining to the Draft EIS for the proposed 1976 OCS Oil and Gas General Lease Sale, Gulf of Mexico, OCS Sale No. 41.

If we can be of further assistance, please let us know.

Sincerely,

DeWitt H. Braud, Jr.

DeWitt H. Braud, Jr.
Environmental Coordinator

DHBJR:lh

d. <u>Mississippi</u>

The Mississippi Marine Resources Council submitted comments concerning pipeline corridor impacts.

<u>Disposition</u>:

These comments have been incorporated into the Final Environmental Statement.

3.1 Section III.A.8d (Pipelines) has been modified to reflect present BLM policy.

3.2 Section IV.D. (Special Studies) has been revised in the Final EIS.

RECEIVED

STATE OF MISSISSIPPI ... 20 8 30 AM '75

OFFICE OF THE GOVERNOR

WILLIAM L. WALLER
GOVERNOR

WM. M. HEADRICK
COORDINATOR OF FEDERAL-STATE PROGRAMS

STATE CLEARINGHOUSE FOR FEDERAL PROGRAMS

TO: Bureau of Land Management
Department of the Interior
Post Office Box 53206
New Orleans, Louisiana 70113

State Clearinghouse Numbe
75082601

Date: October 1, 1975

PROJECT DESCRIPTION: Draft Environmental Statement entitled "Proposed 1976 Outer Continental Shelf, Oil and Gas General Lease Sale, Gulf of Mexico, OCS Sale #41."

(x) 1. The State Clearinghouse has received notification of intent to apply for Federal assistance as describe above.

(--) 2. The State Clearinghouse has reviewed the application(s) for Federal assistance described above.

(--) 3. After proper notification, no State agency has expressed an interest in conferring with the applicant(s or commenting on the proposed project.

(--) 4. The proposed project is: ( ) consistent ( ) inconsistent with an applicable State plan for Mississippi

(x) 5. Although there is no applicable State plan for Mississippi, the proposed project appears to be: (x) consistent ( ) inconsistent with present State goals and policies.

COMMENTS: The attached letter from the Mississippi Marine Resources Council is made a part of this Final Clearinghouse action.

This notice constitutes FINAL STATE CLEARINGHOUSE REVIEW AND COMMENT. Th requirements of U.S. Office of Management and Budget Circular No. A-95 have been met at the State level.

Edward A. May, Jr.
Clearinghouse Directo

SUITE 400, WATKINS BLDG. • 510 GEORGE STREET • JACKSON 39201 • (601) 354-7570

/illiam L. Waller
overnor

E. Thomas, P. E.
xecutive Director

Mississippi Marine Resources Counci

Post Office Drawer 959 Long Beach, Mississippi 39560 601-864-4602

September 26, 1975

SEP 29 1975

Mr. Edward A. May, Jr.
Office of Fed-State Programs
Suite 400, Watkins Building
510 George Street
Jackson, Mississippi 39205

Clearinghouse #75082601

Dear Mr. May:

The Mississippi Marine Resources Council has coordinated a review of the Draft Environmental Impact Statement entitled "Proposed 1976 Outer Continental Shelf Oil and Gas General Lease Sale - Gulf of Mexico, OCS Sale #41." The agencies invited to participate includedthe Gulf Coast Research Laboratory, the Mississippi Marine Conservation Commission, the Gulf Regional Planning Commission, and the Southern Mississippi Planning and Development District.

The Draft Statement concerns the State of Mississippi in only a moderate manner since only a few of the tracks are in OCS waters that are adjacent to Mississippi waters and furthermore, it is not likely that any pipelines that should result from production in the sale of these tracks would landfall in Mississippi.

The position of the State of Mississippi in encouraging the development of the nations offshore petroleum resources is well known. The State of Mississippi encourages the development of offshore petroleum reserves as the most logical available alternative to increase the nations energy resources. In addition, Mississippi has advocated the development of an offshore deepwater port facility as a safe means of increasing our petroleum import requirements.

While production from sales south of Mississippi and Alabama have thus far been modest, it is reasonable to presume that as sales continue that producing areas will be found. It is probable then that new pipelines with new landfalls in Mississippi and Alabama will become necessary. When these developments occur then the onshore impacts not only from the pipeline landfalls but the associated economic development will be substantial. These impacts will be more significant to the respective states than the probable hazard from potential oil spills in the production areas. With the thought that the pipeline corridor impacts may be an early effect of new production on OCS lands, the State of Mississippi suggests that the Draft Environmental Impact Statement be modified in two places:

3.1 (1) In Volume 2, page 421, paragraph 2. The language, particularly in the last sentence, should be modified to reflect the present attitudes and thinking of the Bureau of Land Management.

3.2 (2) In Volume 2, page 538, paragraph 1. It is suggested that both the first sentence and the last sentence in this paragraph are ambiguous as presently written. It is suggested that this paragraph be rewritten in its entirety with substantial detail added.

The State of Mississippi is comfortable with the attention given to the biological concerns of the proposed development in the OCS and the attention given to mitigating possible affects to the commercial line sports fishing industry.

We appreciate the opportunity to comment on this statement.

Very truly yours,

J E Thomas

J.E. Thomas, P.E.

JET:lkg

e. Texas

The State of Texas, Division of Planning Coordination, submitted comments from several state agencies pertaining to a wide range of topics.

Disposition:

The majority of the comments have been incorporated into the Final Environmental Impact Statement.

1.1 The onshore effects of this proposal are discussed in sections II. G.1 and I.1 through 5. The disposal of wastes from structures and drilling rigs located in the Federal OCS is regulated by USGS OCS Order No. 7 and the Draft Development Document for Effluent Limitations Guidelines and New Source Performance Standards for the Oil and Gas Extraction Point Source Category EPA, 1974.

1.2 Please refer to response to comment 1.1

2.1 Information pertaining to the national scope of offshore leasing are addressed in sections I.F. and VIII.

2.2 These suggested corrections have been made in Appendix F.

2.3 These corrections have been incorporated in section II.H.1.

7.1 Please refer to response to comment 1.1.

8.1 Please refer to response to comment 2.1.

10.1 - 12.2 These suggested changes have been incorporated into the text of the Final EIS.

OFFICE OF THE GOVERNOR
DIVISION OF PLANNING COORDINATION

OLPH BRISCOE
GOVERNOR

JAMES M. ROSE
DIRECTOR

October 16, 1975

Mr. John L. Rankin
Gulf of Mexico OCS Office
Bureau of Land Management
The Plaza Tower, Suite 3200
1001 Howard Avenue
New Orleans, Louisiana 70113

Dear Mr. Rankin:

The draft environmental impact statement (EIS) for the Proposed Outer Continental Shelf, Oil and Gas General Lease Sale, Gulf of Mexico, OCS Sale No. 41 has been reviewed by the Governor's Division of Planning Coordination and by interested State agencies in accordance with the National Environmental Policy Act of 1969 (NEPA).

The review participants agreed that the document generally conforms to the requirements of the NEPA and, in addition, submitted the following comments for your consideration:

1. The Texas Water Rights Commission (TWRC) noted that the draft EIS provides comprehensive consideration of the matters involved and concurred that a more complete analysis is dependent upon the development and assessment of base line biological and physical data. The TWRC highlighted the need for correlating comprehensive offshore energy planning with the essential planning for related onshore facilities and services. They stated that this action will provide for State-federal coordination and recognition of options and alternatives of State and local government.

1.1 2. The Texas Water Quality Board (TWQB) expressed concern that the draft EIS contains only a minimal consideration of the onshore effects of the proposal. The TWQB emphasized the need for compliance with the permit regulations of their agency for both liquid and solid waste disposal. They also stated that the State of Texas Oil and Hazardous Substance Pollution Contingency Plan of August 28, 1973, would be applicable for any spillage of oil or hazardous substances in coastal waters.

1.2 3. The Texas Parks and Wildlife Department made a specific suggestion for amending Section D, Volume 2, to include structures and drilling rigs in those facilities which are required to conform to garbage, sewage and other solid waste disposal controls established to protect Flower Garden Bank from undue damage.

EXECUTIVE OFFICE BUILDING

2.1 4. The Texas Department of Agriculture stated that there is a much stronger economic justification for the proposed leasing program than is presented in the draft EIS. They stated that employment, fuel production and other economic factors are of national scope, therefore, the assessment should consider the national impacts as well as the impacts on the states adjacent to the Gulf of Mexico.

5. The Texas Industrial Commission supported the proposed lease sale for increased oil production as well as possible corollary benefits in mineral exploration.

2.2 6. The Texas Coastal and Marine Council offered no major comments but suggested the need for clarification of the description of the ports at Port Arthur and Beaumont. They also questioned the ommission of the Port of Brownsville from the listing of Gulf Coast ports.

2.3 7. The Texas Air Control Board provided specific data for corrections to errors in tabulation of emissions and air standards in the draft EIS.

The State Department of Highways and Public Transportation and the Bureau of Economic Geology also participated in this review. The detailed comments of the review participants are enclosed to assist your planning effort.

The Division of Planning Coordination recognizes the need for increased domestic oil and gas production. We believe that the draft EIS generally conforms to the requirements of the NEPA in considering the environmental impacts of the proposed oil and gas lease. We recommend that you consider the comments of the review participants in the revision of the draft EIS.

If we can be of further assistance, please let us know.

Sincerely,

James M. Rose

JAMES M. ROSE
Director

JMR:cc7/7

Enclosures

cc: Hon. John C. White, TDA
Mr. Robert E. Schneider, TWRC
Mr. Hugh C. Yantis, Jr., TWQB
Mr. Clayton T. Garrison, TP&WD
Mr. James H. Harwell, TIC
Mr. Joe Moseley, TCMC
Mr. Charles R. Barden, TACB
Mr. B.L. DeBerry, SDH&PT
Dr. Charles G. Groat, BEG

TEXAS WATER RIGHTS COMMISSION
STEPHEN F. AUSTIN STATE OFFICE BUILDING

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JOE R. CARROLL
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R. E. (BOB) SCHNEIDER
EXECUTIVE DIRECTOR
475-2452

MARY ANN HEFNER
SECRETARY
475-4514

September 22, 1975

RECEIVED

Brigadier General James M. Rose
Director, Division of Planning Coordination
Office of the Governor
411 West 13th Street
Austin, Texas 78701

Attention: Mr. Wayne N. Brown

Re: U.S. Department of the Interior (USDI), Bureau of Land Management (BLM), Draft Environmental Statement: Proposed 1976 Outer Continental Shelf, Oil and Gas General Lease Sale, Gulf of Mexico, (OCS Sale No. 41) (In 3 Vols., undated; transmitted by USDI BLM Ltr., 3310 #41 (732), August 19, 1975.)

Dear General Rose:

As requested in your letter of September 2, the Commission staff has reviewed the referenced documents and related papers, pursuant to US OMB No. A-95, and finds that the document:

1. Fulfills reasonably the analytical, coordinative, and administrative requirements of Section 102(2)(C), P.L. 91-190, insofar as the leasing phase of the action is concerned.

2. Gives proper and adequate assurances that complete social, economic, technical, and environmental analyses will be made prior to the oil and gas exploration and development phases of the Outer Continental Shelf (OCS), pursuant to the provisions of the Outer Continental Shelf Lands Act; National Environmental Policy Act; Federal Water Pollution Control Act; Marine Protection, Research, and Sanctuaries Act; and the Coastal Zone Management Act -- and the implementing Federal regulations of these Acts.

3. Concedes that it is difficult to evaluate adequately the environmental consequences of OCS exploration and development without prior compilation and analysis of baseline biological and physical data.

4. Reflects that adequate efforts must and will be made to undertake continuing research to determine the persistence and full degree of toxicity of petroleum compounds in the several project areas involved, offshore and onshore.

5. Incorporates the vital requirement that comprehensive energy planning offshore must take place within a framework which recognizes and emphasizes the need for correlative onshore planning.

6. Reflects cognizance that present pre-leasing procedures do not provide sufficient time for the adequate or timely acquisition of the necessary information for State and local governmental planning.

7. Recognizes that more meaningful evaluation by State and local governments of development options and alternatives based on post-exploration knowledge of OCS activities is essential. (However, more specific mention properly could be made in the document of the relevant fact that some of the Coastal States are depending on their own Coastal Zone Management Programs (CZMP) as the major means of controlling what happens onshore due to increased Federal OCS and State offshore energy-related activities.)

8. Presents complex interdisciplinary and intergovernmental coordination requirements, the analysis of which leads to the strong conclusion that the comprehensive analysis of the social, economic, and environmental effects of future OCS exploration and development should be achieved on a programmatic basis under the leadership of one agency -- an agency also responsible for streamlining and coordinating the issuance of the necessary Federal and State licenses

and permits involved in the extensive, expedited OCS exploration and development activities, as contemplated. (The present plethora of regulations and fragmentation of responsibilities and authority potentially could paralyze the full and rapid development of the OCS by virtue of administrative over-regulation.)

9. Gives adequate assurances that extensive mitigating measures will be developed and adopted to eliminate serious risks and jeopardy to human life, the environment, public and private investments, and to property and water rights.

If you have any questions on the above comments, please notify Dr. A. J. D'Arezzo, Special Analyst for Environment and Interagency Coordination, telephone (512)475-2678.

Sincerely yours,

Robert E. Schneider
Executive Director

RES-AJD:ll

TEXAS WATER QUALITY BOARD

RECEIVED

3

1700 NORTH CONGRESS AVE. 78701
P.O. BOX 13246 CAPITOL STATION 78711
AUSTIN, TEXAS

September 22, 1975

Re: Draft Environmental Statement
1976 Outer Continental Shelf
Oil and Gas General Lease Sale No. 4[illegible]

General James M. Rose, Director
Division of Planning Coordination
Office of the Governor
P. O. Box 12428, Capitol Station
Austin, Texas 78711

Dear General Rose:

The staff of the Texas Water Quality Board has reviewed the draft environmental statement concerning the proposed 1976 Outer Continental Shelf Oil and Gas General Lease Sale No. 41 and finds the statement to cover most of the important environmental issues connected with oil and gas production. We have some concern that the assessment contains only a minimal evaluation of the possible affect the offshore activity would have on the shoreward area. The groundwater offshore would not be adversely affected since it is not considered to be of usable quality, but as we have previously stated, the coastline of Texas is unique and the environmental impacts warrant special note and attention. On shore facilities and their environmental impact will need to be assessed, and they will need to comply with the permit regulations of the Texas Water Quality Board for both liquid and solid waste disposal. Also, in instances of any spillage of oil or hazardous substances in coastal waters, the State of Texas Oil and Hazardous Substances Pollution Contingency Plan of August 28, 1973 will become effective.

We appreciate the opportunity to review this draft environmental statement If we can be of further assistance, please let us know.

Very truly yours,

Emory G. Long

Emory G. Long, Director
Administrative Operations

cc: TWQB District 6, 7, 11 & 12

PARKS AND WILDLIFE DEPARTMENT

CLAYTON T. GARRISON
EXECUTIVE DIRECTOR

JOHN H. REAGAN BUILDING
AUSTIN, TEXAS 78701

September 8, 1975

Mr. Wayne N. Brown
Office of the Governor
Division of Planning Coordination
P. O. Box 12428, Capitol Station
Austin, Texas 78711

Reference is made to the Draft Environmental Statement prepared by the Bureau of Land Management for the 1976 Outer Continental Shelf Sale No. 41 (Gulf of Mexico) which you forwarded for review and comment by this Department.

We believe the draft statement is generally adequate; however, we suggest that Volume 2, Section D.1(b), paragraph 5 (page 542) be amended to read as follows:

7.1 "No garbage, untreated sewage, or other solid waste shall be disposed from vessels (work-boats, crew-boats, supply boats, pipe-laying vessels), structures or drilling rigs during exploration and development operations within the area of the bank described above for exploration and development operations."

We believe that the inclusion of structures and drillings rigs in this special stipulation is necessary for the protection of the Flower Garden Banks from undue damage.

Thank you for the opportunity to review and comment on this draft statement.

Sincerely,

CLAYTON T. GARRISON
Executive Director

CTG:BDK:pm

EDMUND L. NICHOLS
Assistant Commissioner

RECEIVED

September 8, 1975

Mr. Wayne N. Brown, Chief
Intergovernmental Coordination
Division of Planning Coordination
Office of the Governor
Austin, Texas 78711

Dear Wayne:

This is in response to your letter of September 2, 1975, requesting comments on Draft Environmental Impact Statement: Proposed 1976 Outer Continental Shelf Oil and Gas General Lease Sale, Gulf of Mexico (OCS) Sale No. 41 From the Bureau of Land Management, U.S. Department of Interior.

We have reviewed these documents. They fully describe the environmental setting, often to the point of including irrelevant material which makes for ponderous reading.

8.1 Our only substantive criticism of these volumes is that the economic analysis is limited to the effects on the states adjacent to the Gulf of Mexico. In fact, the economic impacts, including secondary effects such as employment and production, are national in scope. Thus, there is a much stronger economic justification for the leasing program than is presented.

We appreciate the opportunity to review these important documents.

Sincerely,

E. L. Nichols

Edmund L. Nichols

ELN/pcf

TEXAS INDUSTRIAL COMMISSION

714 Sam Houston State Office Building 512-475-4331 Box 12728, Capitol Station, Austin, Texas 78711 Telex No. 776-4

MEMORANDUM

TO: Mr. Albert D. Schutz

FROM: Phyllis Procter

SUBJECT: Draft Environmental Impact Statement Proposed 1976 Outer Continental Shelf Oil and Gas General Lease Sale, Gulf of Mexico (OCS) Sale No. 41 from the Bureau of Land Management, U.S. Department of Interior

DATE: September 24, 1975

Since existing refinery capacity and onshore supportive industries will continue to be utilized even if for processing imported oil, it seems economically efficient to allow sale of these leases. Detrimental environmental effects appear to be minimized by precautions in operating procedures.

The obvious necessity for oil exploration is recognized by our agency, also hoping for corollary benefits in mineral exploration.

TEXAS COASTAL AND MARINE COUNCIL

RECEIVED
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September 24, 1975

Mr. Wayne N. Brown, Chief
Intergovernmental Coordination
Division of Planning Coordination
Executive Office Bldg.
411 West 13th Street
Austin, Texas

Dear Wayne:

We have received D.E.S. for O.C.S. Sale 41, 1976 Outer Continental Shelf general lease sale, Gulf of Mexico, and have no major comments to offer at this time.

10.1 We are confused, however, by parts of Appendix F. On page 832 the Port of Port Arthur is shown as being 81 miles from 120-foot depth--in the Gulf we assume. Yet on page 835, the Port of Beaumont is only 48 miles from the same depth--obvious since both use the same jettied entrance channel. Total omission of the Port of Brownsville seems also to indicate some data to be hastily assembled and not too well researched.

Sincerely,

Howard T. Lee

Howard T. Lee
Director for Programs

HTL/lr
cc: Mr. Al Cisneros
Mr. Dow Wynn
Mr. J. W. Martin

POST OFFICE BOX 13407 / AUSTIN, TEXAS 78711 / PHONE (512) 476-3561

TEXAS AIR CONTROL BOARD

PHONE 512/451-5711
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JOE C. BRIDGEFARMER, P.

September 25, 1975

Mr. Wayne N. Brown, Chief
Intergovernmental Coordination
Planning Coordination
Governor's Office
Executive Office Building
411 West 13th Street
Austin, Texas 78701

Dear Mr. Brown:

Our agency has reviewed the Draft Environmental Impact Statement - Proposed 1976 Outer Continental Shelf Oil and Gas General Lease Sale, Gulf of Mexico Sale No. 41. We have the following comments:

11.1 Page 275, 276
The secondary standard for Sulfur Oxides annual arithmetic mean and 24-hour maximum have been rescinded.

11.2 Page 278, Table 42
The Texas Implementation Plan submitted in February of 1972 indicated some difficulties with several air pollutants in the Houston-Galveston (#216), Corpus Christi-Victoria (#214), Brownsville-Laredo (#213) regions. Subsequent measurements made in 1972 in the Texas portion of the Southern-Louisiana - Southeast Texas (#106) region also revealed some air pollution problems. The following table from the Texas Implementation Plan indicates the priorities assigned to these coastal regions for specific pollutants. Priority I indicates measurements above the primary standards and the requirement for controls to reduce pollutant concentrations.

	Brownsville (213)	Corpus Christi (214)	Houston (216)	S. Louisiana (106)
Sulfur Dioxide	III	I	I	I
Particulate	III	II	I	II
Oxidants	III	I	I	I

This table reflects the region classification as submitted in the original Implementation Plan and the semi-annual updates to this plan through August 15, 1975.

The explanation of the air quality along Texas coast beginning on page 278 and depicted in Table 42 should be corrected to reflect this information from the Texas Implementation Plan.

12.1 Page 285, Table 41
Several emission inventories have been compiled and submitted to the Environmental Protection Agency since 1972. This later information on emissions in Texas coastal area should be used as it more accurately describes the emission in this area.

12.2 Page 425
According to the Environmental Protection Agency definition of reactivity which we use, essentially all of the components of the natural gas analysis listed are non-reactive and would have little impact whether or not they are burned. In addition, the possible emission from crude oil operations would be relatively low in reactive compounds.

Thank you for the review opportunity. If we can assist you further, please contact me.

Sincerely yours,

Bill Stewart

Bill Stewart, P.E.
Director
Control and Prevention

COMMISSION
REAGAN HOUSTON, CHAIRMAN
DEWITT C GREER
CHARLES E SIMONS

STATE DEPARTMENT OF HIGHWAYS AND PUBLIC TRANSPORTATION
AUSTIN, TEXAS 78701

ENGINEER-DIRECTOR
B. L. DEBERRY

September 5, 1975

IN REPLY REFER TO
FILE NO
D8-E 454

U.S. Department of the Interior
1976 Outer Continental Shelf Proposal
Draft Environmental Impact Statement
OCS Sale No. 41

Mr. Wayne N. Brown, Chief
State Planning and Development
Division of Planning Coordination
Office of the Governor
P.O. Box 12428, Capitol Station
Austin, Texas 78711

Dear Sir:

Reference is made to your letter dated September 2, 1975, transmitting a copy of correspondence on the above captioned project.

The Department has reviewed the subject document and has no comments to offer on this matter.

Sincerely yours

B. L. DeBerry
Engineer-Director

By: James M Barr

For R. L. Lewis, Chief Engineer
of Highway Design

RECEIVED
OCT 20 9 04 AM '7

THE UNIVERSITY OF TEXAS AT AUSTIN
BUREAU OF ECONOMIC GEOLOGY
AUSTIN, TEXAS 78712

University Station, Box X
Phone 512—471-1534

September 9, 1975

Mr. Wayne N. Brown, Chief
Division of Planning Coordination
P. O. Box 12428
Austin, Texas 78711

Dear Mr. Brown:

The staff of the Bureau of Economic Geology has reviewed the following:

(1) Draft Environmental Impact Statement and Unit Plan for the Conroe Unit, Sam Houston National Forest, Texas.

(2) Negative Environmental Declaration: Fort Bend County F.M. 1640.

(3) Draft Environmental Impact Statement Proposed 1976 Outer Continental Shelf Oil and Gas General Lease Sale, Gulf of Mexico (OCS) Sale No. 41.

We have no negative statements on these projects. Thank you for the opportunity to respond.

Sincerely,

C. G. Groat
Acting Director

CGG:wll

3. Public Hearing Testimony and Record

On September 23-24, 1975, the Department of the Interior held a public hearing in Mobile, Alabama for the purpose of receiving views, comments, and suggestions related to the Proposed Outer Continental Shelf Oil and Gas Lease Sale in the Gulf of Mexico (proposed OCS Sale No. 41).

Michael A. Lasher, an Administrative Law Judge, presided as Hearing Officer. The hearing panel consisted of June Whelan, Special Assistant to the Secretary of the Interior for the Southeast Region; Douglas P. Wheeler, Deputy Assistant to the Secretary of the Interior for Fish, Wildlife and Parks; Roland G. Robinson, Jr., Deputy Assistant to the Secretary of the Interior for Land and Water Resources; Donald Truesdell, Chief, Division of Minerals and Environmental Assessment, Bureau of Land Management. Backing up the hearing panel was a technical panel of representatives: John Rankin, Manager, New Orleans OCS Office, Bureau of Land Management; James Kirkwood, U. S. Fish and Wildlife Service; Bill Martin and Joe Jones, U. S. Geological Survey.

Twenty persons submitted oral and/or written testimony for the hearing record. They represented state and local government units, the petroleum and related industries, utility and service companies, universities, and private citizens. All comments received were in favor of the proposed lease sale in general.

The position set forth in the bulk of the testimony was that offshore development was compatible with the environment due to present technology, regulations, and safety records. Many individuals noted

the positive impact of offshore development on the regional economies. Where inaccuracies in the data presented in the draft statement were pointed out, changes have been made. Where omissions of information were cited, they were added to the statement. In all cases, specific and applicable information has been incorporated into the statement.

The hearing record, including 120 page transcript of the oral testimony and all written testimony submitted, is available for inspection at the Office of the Manager, New Orleans OCS Office, Bureau of Land Management, Suite 3200, The Plaza Tower, 1001 Howard Avenue, New Orleans, Louisiana 70113; and at the Office of Public Affairs, Bureau of Land Management (130), Washington, D. C. 20240.

a. Persons who submitted oral and/or written testimony for the public hearing record

	Name	Agency, Organization or Individual
1.	Dr. James I. Jones	Representing Governor State of Florida
2.	Arnold C. Chauviere	Representing Governor State of Louisiana
3.	Jeff East	Representing Governor State of Mississippi
4.	Finas P. Jones	Representing Honorable James E. Fitzmorris, Lt. Governor, State of Louisiana
5.	John M. Gosdin	Governor's Energy Advisory Council of Texas
6.	J. E. Thomas	Executive Director, Mississippi Marine Resources Council
7.	J. Edwin Rehm	Oil and Gas Committee, Mobile Area Chamber of Commerce
8.	William M. Meyers	Attorney, Offshore Operators Committee
9.	Brudge Elkin	Exxon Company, U.S.A.
10.	D. V. Hester	Asst. Division Manager Offshore, Texaco Inc.
11.	Dr. Carl Oppenheimer	Marine Science Institute, University of Texas
12.	R. J. Robicheaux	Otis Engineering Corporation
13.	Dr. Alfred E. Smalley	Professor of Biology, Tulane University
14.	K. A. Ring	Manager, Safety and Environmental Division, Shell Oil Company

Name	Agency, Organization or Individual
15. J. T. Dudley	Manager, Singing River Electric Power Association, Lucedale, Mississippi
16. Edwin O. Bell	Leasing Manager, Mobil Oil Corporation
17. John Bennington	Representing Dr. Thomas J. Bright, Texas A & M University, Dept. of Oceanography
18. W. H. Holland	Executive Vice-President, Mobil Gas Service Corporation
19. David Turner	Representing Philip Lamereaux, State Geologist and Oil and Gas Supervisor, State of Alabama
20. O. L. Adams	Private Citizen

b. <u>Persons who submitted written comments following the public hearing</u>

Name	Agency, Organization, or Individual
1. E. A. Adomat	Florida Power and Light Company
2. M. Austin	Florida L. P. Gas Association
3. J. Beasely	Lieut. Governor - Alabama
4. J. Bennett	Jackson County Planning Commission
5. W. H. Bevis	Florida Public Service Commission
6. D. R. Bowen	U. S. Congress
7. F. B. Bowen	Lakeland, Florida
8. J. Breaux	U. S. Congress
9. W. M. Chappell	Exxon Company
10. C. H. Corn	City of Tallahassee
11. T. Cochran	U. S. Congress
12. H. L. Culbreath	Tampa Electric Company
13. C. R. Dubuisson	Long Beach Chamber of Commerce
14. A. R. Dye, Jr.	Pensacola Chamber of Commerce
15. J. Edwards	U. S. Congress
16. D. K. Galtney	American Association Petroleum Landmen
17. H. B. Hamilton	Mississippi State Port Authority
18. H. Hansen	American Institute Petroleum Geologists
19. J. E. Hanford	Florida Gas Transmission Company
20. W. Harang	Mayor, Thibodaux, Louisiana
21. R. Heath	Suncoast Seabrid Sanctuary
22. F. E. Hebert	U. S. Congress
23. T. J. Hoz	Ted J. Hoz and Associates

Name	Agency, Organization, or Individual
24. D. H. Inskip	Greater Port of Pascagoula
25. J. B. Johnston	U. S. Senate
26. B. Jones	Southeastern Fisheries Assoc., Inc.
27. L. B. Lampton	Mississippi Energy Fuel Adv. Commission
28. M. Landrieu	Mayor, New Orleans
29. T. Lott	U. S. Congress
30. J. A. Martiniere	Biloxi Port Commission
31. G. C. Matthews	Naples, Florida
32. E. H. Mercer	Panama City Port Authority
33. M. B. Miller	Panama City
34. G. V. Montgomery	U. S. Congress
35. W. H. Moore	Mississippi Geol. Econ. & Topo. Survey
36. J. M. Muckleroy	National Petroleum Comp., Inc.
37. D. R. Muller	Nuclear Reg. Commission
38. T. Munro	Harrison County Devel. Commission
39. B. Nichols	U. S. Congress
40. J. H. North	Florida Gas Company
41. J. T. Okeefe	Mississippi Manufacturers Association
42. L. D. Owen	Alabama Senate
43. J. R. Place	Cities Service Oil Company
44. D. B. Purvis	Inter. Geochemists, Ltd.
45. J. B. Ross	Mississippi Dept. of Agri. and Comm.
46. V. Scoper, Jr.	Mississippi House of Representatives
47. J. Sparkman	U. S. Senate
48. J. Stennis	U. S. Senate

Name	Agency, Organization, or Individual
49. L. E. Stone	Orlando Utilities Commission
50. D. C. Treen	U. S. Congress
51. J. M. Van Dyck	Southern National Gas Company
52. J. D. Waggonner, Jr.	U. S. Congress
53. L. Welch	Houston Chamber of Commerce
54. H. Woodbury	Gulfport Area Chamber of Commerce
55. C. H. Williams	Mid-Continent Oil & Gas Association
56. H. H. Williams	Florida Power Corp.
57. D. Wylie	Biloxi Chamber of Commerce
58. A. Avent	Pascagoula-Moss Point Area
59. W. Bennett	Bay County Chamber of Commerce
60. L. Boggs	U. S. Congress
61. C. M. Davis	Committee of 100 (Greater Tampa Chamber of Commerce)
62. W. G. Dees	County of Jackson Mississippi
63. W. M. Meyers	Liskow & Lewis
64. W. W. Webre	Hancock County Port and Harbor Commission
65. E. Whitaker	Private Citizen

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and S. R. Petrocelli. 1975. Sublethal effects of oil, heavy metals and PCS's on marine organisms. In: Proc. of the Mechanisms of Survival in Toxic Environments. Dec. 1973. Academic Press.

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XI. APPENDIX

APPENDIX A

LIST OF TRACTS PROPOSED FOR LEASING IN SALE #41

Tract Number	Block	Description	Acreage	Type/ Res.	Distance From Shore (S.Miles)	Water Depth (Meters)
Mustang Island Area						
1	741	All	5760	III/G	23	32
2	754	All	5760	"	22	30
Matagorda Island Area						
3	600	1/	4058.88	"	11	21
4	624	1/	5617.16	"	11	23
5	699	All	5760	"	23	29
Brazos Area						
6	A-16	All	5760	"	43	40
7	374	1/	1200	II/G	12	18
8	400	N½	2880	"	11	18
High Island Area						
9	31)	1/	35	II/O&G	11	11
	32)	1/	3345	"	11	12
10	33	1/	4740	"	11	11
11	51	All	5760	"	14	13
High Island Area - South Addition						
12	A-500	All	5760	III/G	85	59
13	A-525	All	5760	"	90	69
14	A-527	All	5760	"	89	60
15	A-538	All	5760	I/G	89	71
16	A-543	All	5760	III/G	95	75
17	A-551	All	5760	"	96	77
18	A-552	All	5760	"	95	77
19	A-574	All	5760	"	107	97
High Island Area - East Addition - South Extension						
20	A-280	All	5760	"	90	51
21	A-287	All	5760	"	92	57
22	A-288	All	5760	"	94	57

Tract Number	Block	Description	Acreage	Type/ Res.	Distance From Shore (S.Miles)	Water Depth (Meters)
High Island Area - East Addition - South Extension Cont.						
23	A-352	All	5760	III/G	116	88
24	A-361	All	5760	"	112	91
25	A-374	All	5760	"	121	91
26	A-375	All	5760	"	121	91
27	A-379	All	5760	"	108	91
28	A-381	All	5760	I/G	107	91
29	A-384	All	5760	III/G	121	91
30	A-392	All	2903	"	127	146
31	A-395	All	5760	"	121	152
West Cameron Area						
32	28	S½N½S½;S½S½	1875	I/G	4	8
33	37	All	5000	II/G	7	9
34	143	All	5000	I/G	22	13
35	226	All	5000	III/G	40	15
West Cameron Area - West Addition						
36	342	All	5000	III/G	50	22
West Cameron Area - South Addition						
37	583	All	5000	III/G	110	71
38	607	All	5000	II/G	116	91
39	631	All	5000	III/G	116	107
East Cameron Area						
40	41	All	5000	III/O&G	10	12
41	218	All	1440.77	"	63	35
42	219	All	5000	"	63	35
43	220	All	5000	"	64	35
44	233	All	5000	III/G	67	37
45	234	All	5000	"	67	37
46	235	All	1384.67	"	65	37
East Cameron Area - South Addition						
47	246	All	5000	III/G	75	40
48	367	All	5000	"	108	110

Tract Number	Block	Description	Acreage	Type/ Res.	Distance From Shore (S.Miles)	Water Depth (Meters)
Vermilion Area						
49	61	All	4307.19	III/O&G	14	15
50	65	All	5000	"	17	12
Vermilion Area - South Addition						
51	261	All	5429.23	III/O&G	71	37
52	375	All	5000	III/G	102	91
53	392	All	5000	"	105	73
South Marsh Island Area - South Addition						
54	124	All	5000	"	85	55
South Marsh Island Area - North Addition						
55	241	2/	661	III/O&G	14	6
56	242	2/	2507	"	16	6
Eugene Island Area						
57	251	All	5000	"	54	44
Eugene Island Area - South Addition						
58	289	All	5000	III/G	68	61
59	337	All	5000	I/O	77	77
60	345	All	5000	III/O&G	69	91
61	346	All	5000	I/O&G	72	98
62	350	All	5000	III/G	77	91
63	390	All	5000	"	90	123
Ship Shoal Area						
64	345	All	5000	"	74	123
South Timbalier Area						
65	35	All	5000	III/O&G	15	15
South Pass Area						
66	6	3/	320	I/O	4	6

Tract Number	Block	Description	Acreage	Type/ Res.	Distance From Shore (S. Miles)	Water Depth (Meters)
South Pass Area - South Addition						
67	75	All	5000	III/O&G	17	110
68	76	All	5000	III/O&G	19	91
Main Pass Area						
69	43	W½W½NW¼;NW¼SW¼;				
	&	W½NE¼SW¼	1404.70	I/O	8	10
	44	SE¼NE¼;NE¼SE¼		I/O	8	6
Main Pass Area - South & East Addition						
70	304	All	4999.96	III/G	26	73
Breton Sound Area						
71	53	4/	781	I/O	11	6
New Orleans South No. 1						
72	N641E131	All	5744.12	III/G	94	140
Mobile South No. 1						
73	N686E75	All	5760	III/O&G	20	30
Mobile South No. 2						
74	N660E59	All	3283.56	III/O&G	18	170
75	N661E61	All	5611.56	III/O&G	12	200
Pensacola South No. 1						
76	N677E122	All	5760	III/O&G	50	60
77	N678E125	All	5760	III/O&G	41	50
78	N679E125	All	5760	III/O&G	41	45
79	N680E124	All	5760	III/O&G	38	45
80	N680E125	All	5760	III/O&G	35	40
Apalachicola						
81	N665E153	All	5760	III/O&G	49	30
82	N665E154	All	5760	III/O&G	56	30
Apalachicola South						
83	N664E153	All	5760	III/O&G	54	40
84	N664E154	All	5760	III/O&G	58	40

Tract Number	Block	Description	Acreage	Type/ Res.	Distance From Shore (S.Miles)	Water Depth (Meters)
Tarpon Springs						
85	N644 E49	All	5760	III/O&G	53	35
86	N645 E49	All	5760	"	54	35
87	N645 E50	All	5760	"	51	35
88	N646 E49	All	5760	"	55	35
89	N649 E55	All	5760	"	38	25
90	N650 E53	All	5760	"	45	25
91	N650 E54	All	5760	"	41	25
92	N650 E55	All	5760	"	41	25
93	N651 E52	All	5760	"	48	30
94	N651 E53	All	5760	"	45	25
Tampa						
95	N624 E44	All	5760	"	81	70
96	N626 E45	All	5760	"	75	60
97	N627 E45	All	5760	"	73	60
98	N627 E46	All	5760	"	70	60
99	N633 E44	All	5760	"	69	60
100	N634 E44	All	5760	"	68	60
101	N634 E45	All	5760	"	66	55
102	N636 E55	All	5760	"	36	30
103	N636 E56	All	5760	"	32	30
104	N636 E57	All	5760	"	30	30
105	N637 E56	All	5760	"	32	30
106	N637 E57	All	5760	"	28	30
107	N637 E58	All	5760	"	26	25
108	N638 E43	All	5760	"	69	50
109	N638 E44	All	5760	"	67	50
110	N638 E52	All	5760	"	43	40
111	N638 E53	All	5760	"	40	40
112	N638 E54	All	5760	"	36	35
113	N638 E55	All	5760	"	34	35
114	N639 E43	All	5760	"	69	50
115	N639 E44	All	5760	"	67	50
116	N639 E52	All	5760	"	43	40
Tampa West No. 1						
117	N621 E160	All	5760	"	101	120
118	N621 E161	All	5760	"	99	110
119	N622 E160	All	5760	"	101	120
120	N622 E161	All	5760	"	98	110
121	N623 E160	All	5760	"	99	120

Tract Number	Block	Description	Acreage	Type/ Res.	Distance From Shore (S.Miles)	Water Depth (Meters)
Tampa West No. 1 Cont.						
122	N623 E161	All	5760	III/O&G	98	110
123	N626 E162	All	5760	"	90	90
124	N626 E163	All	5760	"	87	80
125	N627 E162	All	5760	"	88	90
126	N627 E163	All	5760	"	86	80
127	N627 E164	All	5760	"	83	70
128	N627 E165	All	5681.37	"	81	70
129	N628 E162	All	5760	"	87	80
130	N628 E163	All	5760	"	84	80
131	N628 E164	All	5760	"	81	70
132	N628 E165	All	5412.39	"	79	70
133	N629 E163	All	5760	"	83	80
134	N629 E164	All	5760	"	81	80
135	N629 E165	All	5134.56	"	78	70

1/ That portion seaward of the three marine league arc.

2/ That portion located more than three marine leagues seaward of a line extending from a point on Shell Keys at latitude 29°24'32.15"N., longitude 91°51'16.59"W. (X = 1,834,019, Y = 270,301) northwesterly in a straight line to Tigre Point at latitude 29°32'23.13"N., longitude 92°14'57.15"W. (X = 1,708,756, Y = 318,661). The coordinates used refer to the Louisiana Plane Coordinate System, South Zone.

3/ That portion located more than one foot seaward of the Fourth Supplemental Decree Line [409 U.S. 17 (October 16, 1972)].

4/ That portion of the west 1/2 of Block 53 seaward of the Fourth Supplemental Decree Line [409 U.S. 17 (October 16, 1972)].

- A P P E N D I X B -

Proximity Tables

Lease area identification:

MI - Mustang Island Area
MAT - Matagorda Island Area
B - Brazos Area
HI - High Island Area
HIS - High Island Area - South Addition
HES - High Island Area - East Addition - South Extension
WC - West Cameron Area
WCW - West Cameron Area - West Addition
WCS - West Cameron Area - South Addition
EC - East Cameron Area
ECS - East Cameron Area - South Addition
V - Vermilion Area
VS - Vermilion Area - South Addition
SMS - South Marsh Island Area - South Addition
SMN - South Marsh Island Area - North Addition
EI - Eugene Island Area
EIS - Eugene Island Area - South Addition
SSS - Ship Shoal Area - South Addition
ST - South Timbalier Area
S - South Pass Area
SS - South Pass Area - South Addition
MP - Main Pass Area
MSE - Main Pass Area - South and East Addition
BS - Breton Sound Area
NO - New Orleans South No. 1
MSI - Mobile South No. 1
MS2 - Mobile South No. 2
PSI - Pensacola South No. 1
A - Apalachicola
AS - Apalachicola South
TS - Tarpon Springs
T - Tampa
TW - Tampa West

0/0 - First number indicates proximity value to oil spills; second number indicates proximity to structures value.

TRACT DATA				NATURAL AND CULTURAL RESOURCES						MULTIPLE-USE ACTIVITIES				
Lease Area and Tract Number	Distance from Shore (miles)	Approximate Depth (meters)	Estimated Type of Production	Refuge/Wildlife Mgmt. Areas	Beach and Shoreline	Intertidal Communities	Reef Communities	Aesthetics	Archaeology	Shipping	Outdoor Recreation	Commercial Fishing	Sport Fishing	Military Uses
MI-1	23	32	G	0/0	0/0	0/0	0/0	0/0	0/0	0/1.0	0/0	0/0.6	0/0	0/0
MI-2	22	30	G	0/0	0/0	0/0	0/0	0/0	0/0	0/1.0	0/0	0/0.6	0/0	0/0
MAT-3	11	21	G	0/0	0/0	0/0	0/0	0/0.2	0/0	0/0	0/0.2	0/1.0	0/0	0/0
MAT-4	11	23	G	0/0	0/0	0/0	0/0	0/0.2	0/0	0/0	0/0.2	0/1.0	0/0	0/0
MAT-5	23	29	G	0/0	0/0	0/0	0/0	0/0	0/0	0/1.0	0/0	0/0.6	0/0	0/0
B-6	43	40	G	0/0	0/0	0/0	0/0	0/0	0/0	0/0	0/0	0/0.6	0/0	0/0

TRACT DATA				NATURAL AND CULTURAL RESOURCES						MULTIPLE-USE ACTIVITIES				
Lease Area and Tract Number	Distance from Shore (miles)	Approximate Depth (meters)	Estimated Type of Production	Refuge/Wildlife Mgmt. Areas	Beach and Shoreline	Intertidal Communities	Reef Communities	Aesthetics	Archaeology	Shipping	Outdoor Recreation	Commercial Fishing	Sport Fishing	Military Uses
B-7	12	18	G	0/0	0/0	0/0	0/1.0	0/0	0/0	0/0	0/0	0/1.0	0/0	0/0
B-8	11	18	G	0/0	0/0	0/0	0/0	0/0	0/0	0/0	0/0	0/1.0	0/0	0/0
HI-9	11	12	O&G	0/0	0.7/0	0.7/0	1.0/0	0/0	1.0/0	0/0	0/0	1.0/1.0	1.0/0	0/0
HI-10	11	11	O&G	0/0	0.7/0	0.7/0	1.0/0	0/0	1.0/0	0/0	0/0	1.0/1.0	1.0/0	0/0
HI-11	14	13	O&G	0/0	0.5/0	0.5/0	1.0/0	0/0	1.0/1.0	0/0	0/0	1.0/1.0	1.0/0	0/0
HIS-12	85	59	G	0/0	0/0	0/0	0/0	0/0	0/0	0/0	0/0	0/0.6	0/0	0/0

TRACT DATA				NATURAL AND CULTURAL RESOURCES						MULTIPLE-USE ACTIVITIES				
Lease Area and Tract Number	Distance from Shore (miles)	Approximate Depth (meters)	Estimated Type of Production	Refuge/Wildlife Mgmt. Areas	Beach and Shoreline	Intertidal Communities	Reef Communities	Aesthetics	Archaeology	Shipping	Outdoor Recreation	Commercial Fishing	Sport Fishing	Military Uses
HIS-13	90	69	G	0/0	0/0	0/0	0/0	0/0	0/0	0/0	0/0	0/0.4	0/0	0/0
HIS-14	89	60	G	0/0	0/0	0/0	0/0	0/0	0/0	0/0	0/0	0/0.6	0/0	0/0
HIS-15	89	71	G	0/0	0/0	0/0	0/0	0/0	0/0	0/0	0/0	0/0.4	0/0	0/0
HIS-16	95	75	G	0/0	0/0	0/0	0/0	0/0	0/0	0/0	0/0	0/0.4	0/0	0/0
HIS-17	96	77	G	0/0	0/0	0/0	0/0	0/0	0/0	0/0	0/0	0/0.4	0/0	0/0
HIS-18	95	77	G	0/0	0/0	0/0	0/0	0/0	0/0	0/0	0/0	0/0.4	0/0	0/0

TRACT DATA				NATURAL AND CULTURAL RESOURCES						MULTIPLE-USE ACTIVITIES				
Lease Area and Tract Number	Distance from Shore (miles)	Approximate Depth (meters)	Estimated Type of Production	Refuge/Wildlife Mgmt. Areas	Beach and Shoreline	Intertidal Communities	Reef Communities	Aesthetics	Archaeology	Shipping	Outdoor Recreation	Commercial Fishing	Sport Fishing	Military Uses
HIS-19	107	97	G	0/0	0/0	0/0	0/0	0/0	0/0	0/0	0/0	0/0.4	0/0	0/0
HES-20	90	51	G	0/0	0/0	0/0	0/0	0/0	0/0	0/0	0/0	0/0.6	0/0	0/0
HES-21	92	57	G	0/0	0/0	0/0	0/0	0/0	0/0	0/0	0/0	0/0.6	0/0	0/0
HES-22	94	57	G	0/0	0/0	0/0	0/0	0/0	0/0	0/0	0/0	0/0.6	0/0	0/0
HES-23	116	88	G	0/0	0/0	0/0	0/0	0/0	0/0	0/0	0/0	0/0.4	0/0	0/0
HES-24	112	91	G	0/0	0/0	0/0	0/0	0/0	0/0	0/0	0/0	0/0.4	0/0	0/0

TRACT DATA				NATURAL AND CULTURAL RESOURCES						MULTIPLE-USE ACTIVITIES				
Lease Area and Tract Number	Distance from Shore (miles)	Approximate Depth (meters)	Estimated Type of Production	Refuge/Wildlife Mgmt. Areas	Beach and Shoreline	Intertidal Communities	Reef Communities	Aesthetics	Archaeology	Shipping	Outdoor Recreation	Commercial Fishing	Sport Fishing	Military Uses
HES-25	121	91	G	0/0	0/0	0/0	0/1.0	0/0	0/0	0/0	0/0	0/1.0	0/0	0/0
HES-26	121	91	G	0/0	0/0	0/0	0/1.0	0/0	0/0	0/0	0/0	0/1.0	0/0	0/0
HES-27	108	91	G	0/0	0/0	0/0	0/0	0/0	0/0	0/0	0/0	0/0	0/0	0/0
HES-28	107	91	G	0/0	0/0	0/0	0/0	0/0	0/0	0/0	0/0	0/0	0/0	0/0
HES-29	121	91	G	0/0	0/0	0/0	0/1.0	0/0	0/0	0/0	0/0	0/1.0	0/0	0/0
HES-30	127	146	G	0/0	0/0	0/0	0/1.0	0/0	0/0	0/0	0/0	0/1.0	0/0	0/0

TRACT DATA				NATURAL AND CULTURAL RESOURCES						MULTIPLE-USE ACTIVITIES				
Lease Area and Tract Number	Distance from Shore (miles)	Approximate Depth (meters)	Estimated Type of Production	Refuge/Wildlife Mgmt. Areas	Beach and Shoreline	Intertidal Communities	Reef Communities	Aesthetics	Archaeology	Shipping	Outdoor Recreation	Commercial Fishing	Sport Fishing	Military Uses
HES-31	121	152	G	0/0	0/0	0/0	0/0	0/0	0/0	0/0.4	0/0	0/0	0/0	0/0
WC-32	4	8	G	0/0	0/0	0/0	0/0	0/0.4	0/1.0	0/0.4	0/0.4	0/1.0	0/0	0/0
WC-33	7	9	G	0/0	0/0	0/0	0/0	0/0.2	0/0	0/0.4	0/0.2	0/1.0	0/0	0/0
WC-34	22	13	G	0/0	0/0	0/0	0/0	0/0	0/0	0/0.4	0/0	0/1.0	0/0	0/0
WC-35	40	15	G	0/0	0/0	0/0	0/1.0	0/0	0/0	0/0	0/0	0/1.0	0/0	0/0
WCW-36	50	22	G	0/0	0/0	0/0	0/0	0/0	0/0	0/1.0	0/0	0/1.0	0/0	0/0

TRACT DATA				NATURAL AND CULTURAL RESOURCES						MULTIPLE-USE ACTIVITIES				
Lease Area and Tract Number	Distance from Shore (miles)	Approximate Depth (meters)	Estimated Type of Production	Refuge/Wildlife Mgmt. Areas	Beach and Shoreline	Intertidal Communities	Reef Communities	Aesthetics	Archaeology	Shipping	Outdoor Recreation	Commercial Fishing	Sport Fishing	Military Uses
WCS-37	110	71	G	0/0	0/0	0/0	0/1.0	0/0	0/0	0/0	0/0	0/1.0	0/0	0/0
WCS-38	116	91	G	0/0	0/0	0/0	0/0	0/0	0/0	0/0	0/0	0/0.4	0/0	0/0
WCS-39	116	107	G	0/0	0/0	0/0	0/0	0/0	0/0	0/0	0/0	0/0.4	0/0	0/0
EC-40	10	12	O&G	0.7/0	0.7/0	0.7/0	1.0/0	0.7/0.2	1.0/0	0/0	0.7/0.2	1.0/1.0	1.0/0	0/0
EC-41	63	35	O&G	0/0	0/0	0/0	0.7/0	0/0	0/0	0/0	0/0	0.7/0.6	0.7/0	0/0
EC-42	63	35	O&G	0/0	0/0	0/0	0.6/0	0/0	0.7/0	0/0	0/0	0.6/0.6	0.6/0	0/0

TRACT DATA				NATURAL AND CULTURAL RESOURCES						MULTIPLE-USE ACTIVITIES				
Lease Area and Tract Number	Distance from Shore (miles)	Approximate Depth (meters)	Estimated Type of Production	Refuge/Wildlife Mgmt. Areas	Beach and Shoreline	Intertidal Communities	Reef Communities	Aesthetics	Archaeology	Shipping	Outdoor Recreation	Commercial Fishing	Sport Fishing	Military Uses
EC-43	64	35	O&G	0/0	0/0	0/0	0.6/0	0/0	0.6/0	0/0	0/0	0.6/0.6	0.6/0	0/0
EC-44	67	37	G	0/0	0/0	0/0	0/0	0/0	0/0	0/0	0/0	0/0.6	0/0	0/0
EC-45	67	37	G	0/0	0/0	0/0	0/0	0/0	0/0	0/0	0/0	0/0.6	0/0	0/0
EC-46	65	37	G	0/0	0/0	0/0	0/0	0/0	0/0	0/0	0/0	0/0.6	0/0	0/0
ECS-47	75	40	G	0/0	0/0	0/0	0/1.0	0/0	0/0	0/0	0/0	0/1.0	0/0	0/0
ECS-48	108	110	G	0/0	0/0	0/0	0/0	0/0	0/0	0/0	0/0	0/0.6	0/0	0/0

TRACT DATA				NATURAL AND CULTURAL RESOURCES						MULTIPLE-USE ACTIVITIES				
Lease Area and Tract Number	Distance from Shore (miles)	Approximate Depth (meters)	Estimated Type of Production	Refuge/Wildlife Mgmt. Areas	Beach and Shoreline	Intertidal Communities	Reef Communities	Aesthetics	Archaeology	Shipping	Outdoor Recreation	Commercial Fishing	Sport Fishing	Military Uses
V-49	14	15	O&G	0.5/0	0.5/0	0.5/0	0.8/0	0.5/0	1.0/1.0	0/0	0.5/0	0.8/1.0	0.8/0	0/0
V-50	17	12	O&G	0.3/0	0.3/0	0.3/0	1.0/0	0.3/0	1.0/0	0/0	0.3/0	1.0/1.0	1.0/0	0/0
VS-51	71	37	O&G	0/0	0/0	0/0	1.0/0	0/0	0.8/0	0/0	0/0	1.0/0.6	1.0/0	0/0
VS-52	102	91	G	0/0	0/0	0/0	0/0	0/0	0/0	0/0	0/0	0/0.4	0/0	0/0
VS-53	105	73	G	0/0	0/0	0/0	0/1.0	0/0	0/0	0/0	0/0	0/1.0	0/0	0/0
SMS-54	85	55	G	0/0	0/0	0/0	0/0	0/0	0/0	0/0	0/0	0/0.6	0/0	0/0

TRACT DATA				NATURAL AND CULTURAL RESOURCES						MULTIPLE-USE ACTIVITIES				
Lease Area and Tract Number	Distance from Shore (miles)	Approximate Depth (meters)	Estimated Type of Production	Refuge/Wildlife Mgmt. Areas	Beach and Shoreline	Intertidal Communities	Reef Communities	Aesthetics	Archaeology	Shipping	Outdoor Recreation	Commercial Fishing	Sport Fishing	Military Uses
SMN-55	14	6	O&G	0.5/0	0.3/0	0.5/0	1.0/0	0.3/0	1.0/0	0/0	0.3/0	1.0/1.0	1.0/0	0/0
SMN-56	16	6	O&G	0.5/0	0.3/0	0.5/0	1.0/1.0	0.3/0	1.0/0	0/0	0.3/0	1.0/1.0	1.0/0	0/0
EI-57	54	44	O&G	0/0	0/0	0/0	1.0/0	0/0	1.0/0	0/0	0/0	1.0/0.6	1.0/0	0/0
EIS-58	68	61	G	0/0	0/0	0/0	0/0	0/0	0/0.4	0/0	0/0	0/0.6	0/0	0/0
EIS-59	77	77	O	0/0	0/0	0/0	0.8/0	0/0	0.5/0	0.3/0	0/0	0.8/0.4	0.8/0	0/0
EIS-60	69	91	O&G	0/0	0/0	0/0	0.9/0	0/0	0.7/0	0.3/0	0/0	0.9/0.4	0.9/0	0/0

TRACT DATA				NATURAL AND CULTURAL RESOURCES						MULTIPLE-USE ACTIVITIES				
Lease Area and Tract Number	Distance from Shore (miles)	Approximate Depth (meters)	Estimated Type of Production	Refuge/Wildlife Mgmt. Areas	Beach and Shoreline	Intertidal Communities	Reef Communities	Aesthetics	Archaeology	Shipping	Outdoor Recreation	Commercial Fishing	Sport Fishing	Military Uses
EIS-61	72	98	O&G	0/0	0/0	0/0	1.0/0	0/0	0.5/0	0.4/0	0/0	1.0/0.4	1.0/0	0/0
EIS-62	77	91	G	0/0	0/0	0/0	0/0	0/0	0/0	0/0	0/0	0/0.4	0/0	0/0
EIS-63	90	123	G	0/0	0/0	0/0	0/0	0/0	0/0	0/0	0/0	0/1.0	0/0	0/0
SSS-64	74	123	G	0/0	0/0	0/0	0/0	0/0	0/0	0/0	0/0	0/0.8	0/0	0/0
ST-65	15	15	O&G	0/0	0.9/0	0.9/0	0.7/0	0.5/0	1.0/0	0/0	0.5/0	0.7/1.0	0.7/0	0/0
ST-66	4	6	O	1.0/0	1.0/0	1.0/0	0.9/0	1.0/4	0.9/0	1.0/0	1.0/0	0.9/1.0	0.9/0	0/0

TRACT DATA				NATURAL AND CULTURAL RESOURCES						MULTIPLE-USE ACTIVITIES				
Lease Area and Tract Number	Distance from Shore (miles)	Approximate Depth (meters)	Estimated Type of Production	Refuge/Wildlife Mgmt. Areas	Beach and Shoreline	Intertidal Communities	Reef Communities	Aesthetics	Archaeology	Shipping	Outdoor Recreation	Commercial Fishing	Sport Fishing	Military Uses
SS-67	17	110	O&G	0.5/0	0.7/0	0.7/0	0.4/0	0.4/0	1.0/0	1.0/1.0	0.4/0	0.1/0.4	0.1/0	0/0
SS-68	19	91	O&G	0.5/0	0.7/0	0.7/0	0.5/0	0.4/0	1.0/0	1.0/0	0.4/0	0.5/0.4	0.5/0	0/0
MP-69	8	10	O	1.0/0	1.0/0	1.0/0	1.0/0	0.9/0.2	1.0/0	1.0/0	0.9/0	1.0/1.0	1.0/0	0/0
MSE-70	26	73	G	0/0	0/0	0/0	0/0	0/0	0/1.0	0/0	0/0	0/0.8	0/0	0/0
BS-71	11	6	O	1.0/0	1.0/0	1.0/0	1.0/0	0.7/0	0.1/0	1.0/0	0.7/0	1.0/1.0	1.0/0	0/0
NO-72	94	140	G	0/0	0/0	0/0	0/1.0	0/0	0/0	0/0	0/0	0/1.0	0/0	0/0

TRACT DATA				NATURAL AND CULTURAL RESOURCES						MULTIPLE-USE ACTIVITIES				
Lease Area and Tract Number	Distance from Shore (miles)	Approximate Depth (meters)	Estimated Type of Production	Refuge/Wildlife Mgmt. Areas	Beach and Shoreline	Intertidal Communities	Reef Communities	Aesthetics	Archaeology	Shipping	Outdoor Recreation	Commercial Fishing	Sport Fishing	Military Uses
MSI-73	20	30	O&G	0.3/0	0.3/0	0.3/0	0.9/0	0.3/0	0/0	1.0/0	0.3/0	0.9/0.6	0/0	0/0
MS2-74	18	170	O&G	0.4/0	0.4/0	0.4/0	0.4/0	0/0	1.0/0	1.0/1.0	0.4/0	1.0/0.4	1.0/0	0/0
MS2-75	12	200	O&G	0.6/0	0.6/0	0.6/0	0.2/0	0.6/0	1.0/0	1.0/1.0	0.6/0	1.0/1.4	1.0/0	0/0
PSI-76	50	60	O&G	0/0	0/0	0/0	1.0/0	0/0	0.8/0	0/0	0/0	1.0/0.6	1.0/0	0/0
PSI-77	41	50	O&G	0/0	0/0	0/0	1.0/1.0	0/0	1.0/0	0/0	0/0	1.0/1.0	1.0/0	1.0/0.4
PSI-78	41	45	O&G	0/0	0/0	0/0	1.0/1.0	0/0	1.0/1.0	0/0	0/0	1.0/1.0	1.0/0	1.0/0.6

TRACT DATA				NATURAL AND CULTURAL RESOURCES						MULTIPLE-USE ACTIVITIES				
Lease Area and Tract Number	Distance from Shore (miles)	Approximate Depth (meters)	Estimated Type of Production	Refuge/Wildlife Mgmt. Areas	Beach and Shoreline	Intertidal Communities	Reef Communities	Aesthetics	Archaeology	Shipping	Outdoor Recreation	Commercial Fishing	Sport Fishing	Military Uses
PSI-79	38	45	O&G	0/0	0/0	0/0	1.0/1.0	0.0	1.0/0	0/0	0/0	1.0/1.0	1.0/0	1.0/0.4
PSI-80	35	40	O&G	0/0	0/0	0/0	1.0/1.0	0/0	1.0/0	0/0	0/0	1.0/1.0	1.0/0	0.9/0.2
A-81	49	30	O&G	0/0	0/0	0/0	0.6/0	0/0	0.7/0	0/0	0/0	0.6/0.6	0.6/0	1.0/0.4
A-82	56	30	O&G	0/0	0/0	0/0	0.5/0	0/0	1.0/0	0/0	0/0	0.5/0.6	0.5/0	0.8/0.2
AS-83	54	40	O&G	0/0	0/0	0/0	0.5/0	0/0	0.7/0	0/0	0/0	0.5/0.6	0.5/0	0.9/0.2
AS-84	58	40	O&G	0/0	0/0	0/0	0.5/0	0/0	0.9/0	0/0	0/0	0.5/0.6	0.5/0	0.7/0

TRACT DATA				NATURAL AND CULTURAL RESOURCES						MULTIPLE-USE ACTIVITIES				
Lease Area and Tract Number	Distance from Shore (miles)	Approximate Depth (meters)	Estimated Type of Production	Refuge/Wildlife Mgmt. Areas	Beach and Shoreline	Intertidal Communities	Reef Communities	Aesthetics	Archaeology	Shipping	Outdoor Recreation	Commercial Fishing	Sport Fishing	Military Uses
TS-85	53	35	O&G	0/0	0/0	0/0	1.0/0	0/0	0.9/0	0/0	0/0	1.0/0.6	1.0/0	0/0
TS-86	54	35	O&G	0/0	0/0	0/0	1.0/0	0/0	1.0/0	0/0	0/0	1.0/0.6	1.0/0	0/0
TS-87	51	35	O&G	0/0	0/0	0/0	1.0/0	0/0	1.0/0	0/0	0/0	1.0/0.6	1.0/0	0/0
TS-88	55	35	O&G	0/0	0/0	0/0	1.0/1.0	0/0	1.0/0	0/0	0/0	1.0/1.0	1.0/0	0/0
TS-89	38	25	O&G	0/0	0/0	0/0	1.0/0	0/0	1.0/0	0/0	0/0	1.0/1.0	1.0/0	0/0
TS-90	45	25	O&G	0/0	0/0	0/0	1.0/0	0/0	0.6/0	0/0	0/0	1.0/1.0	1.0/0	0/0

TRACT DATA				NATURAL AND CULTURAL RESOURCES						MULTIPLE-USE ACTIVITIES				
Lease Area and Tract Number	Distance from Shore (miles)	Approximate Depth (meters)	Estimated Type of Production	Refuge/Wildlife Mgmt. Areas	Beach and Shoreline	Intertidal Communities	Reef Communities	Aesthetics	Archaeology	Shipping	Outdoor Recreation	Commercial Fishing	Sport Fishing	Military Uses
TS-91	41	25	O&G	0/0	0/0	0/0	1.0/0	0/0	0.8/0	0/0	0/0	1.0/1.0	1.0/0	0/0
TS-92	41	25	O&G	0/0	0/0	0/0	1.0/1.0	0/0	1.0/0	0/0	0/0	1.0/1.0	1.0/0	0/0
TS-93	48	30	O&G	0/0	0/0	0/0	0.8/0	0/0	0.5/0	0/0	0/0	0.8/0.6	0.8/0	0/0
TS-94	45	25	O&G	0/0	0/0	0/0	1.0/0	0/0	0.7/0	0/0	0/0	1.0/1.0	1.0/0	0/0
T-95	81	70	O&G	0/0	0/0	0/0	1.0/1.0	0/0	0/0	0/0	0/0	1.0/1.0	1.0/0	0/0
T-96	75	60	O&G	0/0	0/0	0/0	1.0/1.0	0/0	0/0	0/0	0/0	1.0/1.0	1.0/0	0/0

TRACT DATA				NATURAL AND CULTURAL RESOURCES						MULTIPLE-USE ACTIVITIES				
Lease Area and Tract Number	Distance from Shore (miles)	Approximate Depth (meters)	Estimated Type of Production	Refuge/Wildlife Mgmt. Areas	Beach and Shoreline	Intertidal Communities	Reef Communities	Aesthetics	Archaeology	Shipping	Outdoor Recreation	Commercial Fishing	Sport Fishing	Military Uses
T-97	73	60	O&G	0/0	0/0	0/0	1.0/0	0/0	0/0	0/0	0/0	1.0/6	1.0/0	0/0
T-98	70	60	O&G	0/0	0/0	0/0	1.0/0	0/0	0/0	0/0	0/0	1.0/6	1.0/0	0/0
T-99	69	60	O&G	0/0	0/0	0/0	0.3/0	0/0	1.0/0	0/0	0/0	0.3/0.4	0.3/0	0/0
T-100	68	60	O&G	0/0	0/0	0/0	0.5/0	0/0	1.0/0	0/0	0/0	0.5/0.4	0.5/0	0/0
T-101	66	55	O&G	0/0	0/0	0/0	0.5/0	0/0	1.0/0	0/0	0/0	0.5/0.4	0.5/0	0/0
T-102	36	30	O&G	0/0	0/0	0/0	1.0/1.0	0/0	0.6/0	0/0	0/0	1.0/1.0	1.0/0	0/0

TRACT DATA				NATURAL AND CULTURAL RESOURCES						MULTIPLE-USE ACTIVITIES				
Lease Area and Tract Number	Distance from Shore (miles)	Approximate Depth (meters)	Estimated Type of Production	Refuge/Wildlife Mgmt. Areas	Beach and Shoreline	Intertidal Communities	Reef Communities	Aesthetics	Archaeology	Shipping	Outdoor Recreation	Commercial Fishing	Sport Fishing	Military Uses
T-103	32	30	O&G	0/0	0.1/0	0.1/0	1.0/0	0/0	0.6/0	0/0	0/0	1.0/0.8	1.0/0	0/0
T-104	30	30	O&G	0/0	0.1/0	0.1/0	1.0/1.0	0/0	0.6/0	0/0	0/0	1.0/1.0	1.0/0	0/0
T-105	32	30	O&G	0/0	0.1/0	0.1/0	1.0/1.0	0/0	0.6/0	0/0	0/0	1.0/1.0	1.0/0	0/0
T-106	28	30	O&G	0/0	0.1/0	0.1/0	1.0/1.0	0/0	0.7/0	0/0	0/0	1.0/1.0	1.0/0	0/0
T/107	26	25	O&G	0/0	0.1/0	0.1/0	1.0/1.0	0/0	0.9/0	0/0	0/0	1.0/1.0	1.0/0	0/0
T-108	69	50	O&G	0/0	0/0	0/0	1.0/0	0/0	1.0/0	0/0	0/0	1.0/0.6	1.0/0	0/0

TRACT DATA				NATURAL AND CULTURAL RESOURCES						MULTIPLE-USE ACTIVITIES				
Lease Area and Tract Number	Distance from Shore (miles)	Approximate Depth (meters)	Estimated Type of Production	Refuge/Wildlife Mgmt. Areas	Beach and Shoreline	Intertidal Communities	Reef Communities	Aesthetics	Archaeology	Shipping	Outdoor Recreation	Commercial Fishing	Sport Fishing	Military Uses
T-109	67	50	O&G	0/0	0/0	0/0	1.0/0	0/0	1.0/0	0/0	0/0	1.0/0.6	1.0/0	0/0
T-110	43	40	O&G	0/0	0/0	0/0	1.0/0	0/0	0.2/0	0/0	0/0	1.0/0.6	1.0/0	0/0
T-111	40	40	O&G	0/0	0/0	0/0	1.0/0	0/0	0.3/0	0/0	0/0	1.0/0.6	1.0/0	0/0
T-112	36	35	O&G	0/0	0/0	0/0	1.0/0	0/0	0.3/0	0/0	0/0	1.0/0.6	1.0/0	0/0
T-113	34	35	O&G	0/0	0/0	0/0	1.0/1.0	0/0	0.5/0	0/0	0/0	1.0/1.0	1.0/0	0/0
T-114	69	50	O&G	0/0	0/0	0/0	1.0/1.0	0/0	1.0/0	0/0	0/0	1.0/1.0	1.0/0	0/0

TRACT DATA				NATURAL AND CULTURAL RESOURCES						MULTIPLE-USE ACTIVITIES				
Lease Area and Tract Number	Distance from Shore (miles)	Approximate Depth (meters)	Estimated Type of Production	Refuge/Wildlife Mgmt. Areas	Beach and Shoreline	Intertidal Communities	Reef Communities	Aesthetics	Archaeology	Shipping	Outdoor Recreation	Commercial Fishing	Sport Fishing	Military Uses
T-115	67	50	O&G	0/0	0/0	0/0	1.0/1.0	0/0	1.0/0	0/0	0/0	1.0/1.0	1.0/0	0/0
T-116	43	40	O&G	0/0	0/0	0/0	1.0/0	0/0	0.2/0	0/0	0/0	1.0/0.6	1.0/0	0/0
TW-117	101	120	O&G	0/0	0/0	0/0	0.4/0	0/0	0/0	0/0	0/0	0.4/0.4	0.4/0	0/0
TW-118	99	110	O&G	0/0	0/0	0/0	0.5/0	0/0	0/0	0/0	0/0	0.5/0.4	0.5/0	0/0
TW-119	101	120	O&G	0/0	0/0	0/0	0.4/0	0/0	0/0	0/0	0/0	0.4/0.4	0.4/0	0/0
TW-120	98	110	O&G	0/0	0/0	0/0	0.5/0	0/0	0/0	0/0	0/0	0.5/0.4	0.5/0	0/0

TRACT DATA				NATURAL AND CULTURAL RESOURCES						MULTIPLE-USE ACTIVITIES				
Lease Area and Tract Number	Distance from Shore (miles)	Approximate Depth (meters)	Estimated Type of Production	Refuge/Wildlife Mgmt. Areas	Beach and Shoreline	Intertidal Communities	Reef Communities	Aesthetics	Archaeology	Shipping	Outdoor Recreation	Commercial Fishing	Sport Fishing	Military Uses
TW-121	99	120	O&G	0/0	0/0	0/0	0.4/0	0/0	0/0	0/0	0/0	0.4/0.4	0.4/0	0/0
TW-122	98	110	O&G	0/0	0/0	0/0	0.5/0	0/0	0.1/0	0/0	0/0	0.5/0.4	0.4/0	0/0
TW-123	90	90	O&G	0/0	0/0	0/0	0.7/0	0/0	0.2/0	0/0	0/0	0.7/0.4	0.7/0	0/0
TW-124	87	80	O&G	0/0	0/0	0/0	1.0/0	0/0	0.3/0	0/0	0/0	1.0/0.4	1.0/0	0/0
TW-125	88	90	O&G	0/0	0/0	0/0	0.7/0	0/0	0.3/0	0/0	0/0	0.7/0.4	0.7/0	0/0
TW-126	86	80	O&G	0/0	0/0	0/0	0.9/0	0/0	0.4/0	0/0	0/0	0.9/0.4	0.9/0	0/0

TRACT DATA				NATURAL AND CULTURAL RESOURCES						MULTIPLE-USE ACTIVITIES				
Lease Area and Tract Number	Distance from Shore (miles)	Approximate Depth (meters)	Estimated Type of Production	Refuge/Wildlife Mgmt. Areas	Beach and Shoreline	Intertidal Communities	Reef Communities	Aesthetics	Archaeology	Shipping	Outdoor Recreation	Commercial Fishing	Sport Fishing	Military Uses
TW-127	83	70	O&G	0/0	0/0	0/0	1.0/0	0/0	0.4/0	0/0	0/0	1.0/0.4	1.0/0	0/0
TW-128	81	70	O&G	0/0	0/0	0/0	1.0/0	0/0	0.4/0	0/0	0/0	1.0/0.6	1.0/0	0/0
TW-129	87	80	O&G	0/0	0/0	0/0	0.7/0	0/0	0.4/0	0/0	0/0	0.7/0.4	0.7/0	0/0
TW-130	84	80	O&G	0/0	0/0	0/0	0.8/0	0/0	0.5/0	0/0	0/0	0.8/0.4	0.8/0	0/0
TW-131	81	70	O&G	0/0	0/0	0/0	0.9/0	0/0	0.5/0	0/0	0/0	0.9/0.4	0.9/0	0/0
TW-132	79	70	O&G	0/0	0/0	0/0	1.0/0	0/0	0.5/0	0/0	0/0	1.0/0.4	1.0/0	0/0

TRACT DATA				NATURAL AND CULTURAL RESOURCES						MULTIPLE-USE ACTIVITIES				
Lease Area and Tract Number	Distance from Shore (miles)	Approximate Depth (meters)	Estimated Type of Production	Refuge/Wildlife Mgmt. Areas	Beach and Shoreline	Intertidal Communities	Reef Communities	Aesthetics	Archaeology	Shipping	Outdoor Recreation	Commercial Fishing	Sport Fishing	Military Uses
TW-133	83	80	O&G	0/0	0/0	0/0	0.7/0	0/0	0.6/0	0/0	0/0	0.7/0.4	0.7/0	0/0
TW-134	81	80	O&G	0/0	0/0	0/0	0.8/0	0/0	0.6/0	0/0	0/0	0.8/0.4	0.8/0	0/0
TW-135	78	70	O&G	0/0	0/0	0/0	0.9/0	0/0	0.5/0	0/0	0/0	0.9/0.4	0.9/0	0/0

APPENDIX C

EMERGENCY OIL SPILL CONTROL & CLEANUP EQUIPMENT

1. Spill Booms

A. Mississippi River Delta Area

Operator	Type	Length	Location
Amoco Production Company	3 1/2" Fiberglass	310'	Bastian Bay Field
Exxon Company - U.S.A.	Uniroyal	600'	Lake Washington
	Uniroyal	480'	Potash
	Polytech Rope	300'	Southeast Pass
	Oil Boom	480'	Southeast Pass
Gulf Oil Company - U.S.	D. R. Smart	200'	Bayou Couba
	D. R. Smart	200'	Grand Bay
	T. T. Oil Boom	1000'	Quarantine Bay
	T. T. Oil Boom	100'	Black Bay
	Uniroyal Mini Boom	750'	West Bay Office & Whs.
	36" Bennet Flex-i-flo (250' on reel, 900 in 50 sections)	1150'	Venice, La.
	Slickbar, 6½" float, 6" fin oil boom	200'	Venice
	D. R. Smart, 2" thick x 3' wide, portable oil boom	250'	Venice
	Slickbar, 6½" float, 6" fin oil boom	400'	Ostrica
	D. R. Smart, 2" thick x 3" wide, portable oil boom	180'	Ostrica

A. Mississippi River Delta Area (continued)

Operator	Type	Length	Location
Chevron Oil Co.	6" Slick Bar	200'	Cal-Ky Empire, LA terminal
	T and T	500'	Cal-Ky Empire, LA terminal
	6" Slick Bar	300'	Main Pass Blk 69 terminal
	D. R. Smart	200'	Cal-Ky Empire, LA terminal
	D. R. Smart	400'	Main Pass Blk 69
	T and T	485'	Romere Pass
	D. R. Smart	300'	Romere Pass
	6" Slick Bar	300'	Bay Coquille #1 Battery
	D. R. Smart	600'	Bay Coquille #1 Battery
	D. R. Smart	100'	Southwest Pass E-2
	6" Slick Bar	500'	Southwest Pass W-1
	D. R. Smart	150'	Southwest Pass W-1
	D. R. Smart	200'	Southwest Pass E-5
	6" Slick Bar	200'	Southwest Pass W-6
	D. R. Smart	150'	Southwest Pass W-6
	6" Slick Bar	200'	West Delta Terminal
	T and T	1060'	Venice Base
	D. R. Smart	1300'	Venice Base
	Navy Type Boom construction and Launching Assembly		Venice Base
	Boom Floats, Hose, Chain, Buoys, etc.	Miscellaneous	Venice Base
	36" Uniroyal Boom	1500'	Pascagoula Refinery
	36" Coastal TT Boom	500'	Pascagoula Refinery
	18" Uniroyal Boom	1000'	Pascagoula Refinery
	Parker Systems Snare (1516)	25 boxes	Pascagoula Refinery
	D. R. Smart	500'	Barataria
	D. R. Smart	100'	Delta Farms

A. Mississippi River Delta Area (continued)

Operator	Type	Length	Location
Hunt Oil Company	Uniroyal 18"	200'	Dixon Bay
Shell Oil Company	Bennett T-T	600' 1500' 400' 650'	Venice East Bay Field Empire Block 69 Field
Southern Natural Gas Company	18" Uniroyal	200'	Bayou Segnette (Westwego)
Texas Pipe Line Company	Home made Home made Home made Home made Home made	2000' 200' 200' 100' 300'	Harvey Garden Island Delta Duck Lafitte Pilottown
Texaco, Inc.	Commercial Commercial Commercial Commercial Commercial	800' 500' 500' 800' 750'	Garden Island Lafitte Lake Salvador Delta Duck Delacroix

Operator	Type	Length	Location
Union Oil Co. of California	Uniroyal Mini-boom 6" freeboard-12"draft	320'	Main Pass Block 6
	12"freeboard-24" draft	200'	Main Pass Block 6

B. Grand Isle - Lafourche - Terrebonne Area

Operator	Type	Length	Location
\moco Production Company	3" Fiberglass	300'	Lake Boeuf Field
	3 1/2" Fiberglass	480'	Lake Long Field
	3 1/2" Fiberglass	300'	Lake Raccourci Field
	3 1/2" Fiberglass	200'	Lake Boudreaux Field
	3 1/2" Fiberglass	400'	Bayou des Allemands Field
	4" Fiberglass	70'	Lake Boeuf Field
Continental Oil Company	6"	1100'	Grande Isle
Exxon Company U.S.A	8"Uniroyal C-18 Seal Boom	250'	Pelican Island
	6"Slick Bar	360'	Brenton Canal
	6"Slick Bar	360'	Lirette
	Uniroyal	240'	Paradis
Gulf Oil Company U.S.	Slickbar, 6½", float,6" fin oil boom	200'	Leeville

B. Grand Isle - LaFourche - Terrebonne Area (continued)

Operator	Type	Length	Location
Gulf Oil Company U.S.	D. R. Smart, 2"thick x 3" wide portable spill boom	50'	Leeville
	36" Coastal (Inshore)	600'	Timbalier Bay
	36" Bennett (Inshore)	1000'	Timbalier Bay
	Slick bar (Inshore)	200'	Bully Camp
Shell Oil Company	6"Slickbar	500'	Gibson Unit
		500'	Chauvin Unit
Skelly Oil Company	Conwed Sorbent Boom 8" dia.	600'	Coon Point Onshore Facility Mouth of Grand Bayou DuLarge
Southern Natural Gas Co.	18" Uniroyal	400'	Montegut, La.
Texas Pipe Line Company	Home made	100'	Paradis
	Home made	500'	Houma
	Home made	700'	Cocodrie
	Home made	400'	Golden Meadow
Texaco, Inc.	Commercial	500'	Bay de Chene
	Commercial	440'	Lake Barre
	Commercial	480'	Lake Pelto
	Commercial	600'	Leville
	Commercial	520'	Caillou Island
	Commercial	480'	Bay St. Elaine
	Commercial	500'	Dog Lake
	Commercial	480'	Golden Meadow

B. Grand Isle - Lafourche - Terrebonne Area

Operator	Type	Length	Location
Chevron Oil Company	T and T	160'	Bayou Fourchon Terminal
	D. R. Smart	200'	So. Timbalier
	D. R. Smart	300'	Cut Off
	18" Uniroyal "Mini" Boom	400'	Fourchon Terminal
	36" Uniroyal "Standard" Boom	240'	Fourchon Terminal

B. Grand Isle - LaFourche - Terrebonne Area

Operator	Type	Length	Location
Union Oil Co. of California	Uniroyal Mini-Boom 6" Freeboard-12"draft	320'	Dulac-Offshore Base
	"	320'	Caillou Island S/L 2826
	12"Freeboard-24"draft	320'	Caillou Island S/L 2826

C. Morgan City - Atchafalaya Area

Operator	Type	Length	Location
Cities Service Oil Company	Containment boom (6" diameter float x 12" curtain)	150' (3-50')	Lawson Field (Crowley, La.)
	6" boom	2000'	Lake Charles, La.
Exxon Company U.S.A.	6" Slickbar	650'	Avery Island
	6" Slickbar	200'	Weeks Island
	6" Slickbar	400'	Duck Lake
	Styrofoam	250'	Avery Island
	36" Uniroyal	400'	Duck Lake
	36" Uniroyal	2000'	Baton Rouge Refinery
	18" Uniroyal	350'	Bayou Sale
	All Catch & Sealdboom	750'	Bayou Sale
	Uniroyal	320'	Morgan City
Ker-McGee Corporation	TT4'	1000'	Morgan City
Mobil Oil Corporation	6" Flotation Collar with 18" Skirt	1000'	Intracoastal Loading Dock
Occidental Petroleum Corp.	ACME "OK" Corral	250'	Simon Pass Field

C. Morgan City - Atchafalaya Area (continued)

Operator	Type	Length	Location
Shell Oil Company	6" Slickbar	500'	Morgan City
		300'	Weeks Island
		1700'	West Lake Verret Unit
		750'	Bayou Sorrel Unit
Tenneco Oil Company	6"	300'	Cocodrie
Texas Pipe Line Company	Home made	300'	Baton Rouge
	Home made	200'	Bayou Sale
	Home made	2200'	New Iberia
	Home made	200'	Patterson
	Home made	200'	Sulphur
Texaco, Inc.	Uniroyal Seal Boom 18"	480'	Bateman Lake
	Uniroyal Seal Boom 18"	640'	Bayou Sale
	Uniroyal Seal Boom 18"	160'	Grand Lake
	Uniroyal Seal Boom 18"	200'	Lake Mongoulois
	Acme Boom 18"	300'	Plumb Bob
	Uniroyal Seal Boom 18"	480'	Plumb Bob
	Uniroyal Seal Boom 36"	1040'	West Cote Blanche Bay
	Home made	500'	Morgan City
Union Oil Co. of California	Uniroyal Mini-Boom		
	6" Freeboard - 12" draft	320'	El Block 32
	12" Freeboard - 24" draft	200'	El Block 32
Chevron Oil Co.	T and T	300'	Morgan City
	Sea Curtin	500'	Morgan City

D. Vermilion - Cameron Area

Operator	Type	Length	Location
Amoco Production Co.	5" Float w/8" skirt (spilltrol)	300'	South Florence Field
Exxon Company U.S.A.	6" Slickbar	250'	Pecan Island
	Styrofoam	500'	Pecan Island
	12" Styrofoam	400'	Intracoastal City
Gulf Oil Company U.S.	(SEE NOTE)		
	Note: The Morgan City Area does not have any spill boom equipment in its inventory. Equipment stored in the Leeville Area, Timbalier Bay, and Venice Area is available to this Area. The 36" Bennett Boom (1000' at Venice and 1000' at Leeville) and 600' of 36" Coastal Boom at Timbalier Bay could be used under calm weather conditions at offshore locations.		
Mobile Oil Corporation	1 Absorbent type	50'	Grand Chenier, La.
Phillips Petroleum Company	12" Sea-Curtin Boom	600'	Lafayette, La.
Shell Oil Company	6" Slickbar	650'	Black Bayou Unit
Texas Pipeline Co.	Home made	200'	Lake Arthur
Chevron Oil Co.	T and T	200'	Sabine Terminal
	D. R. Smart	500'	Sabine Terminal
	D. R. Smart	500'	Cedar Point (Cal. Bay)

E. Texas Coast Area

Operator	Type	Length	Location
Atlantic Richfield Co.	6"	200'	Aransas Pass
Exxon Company U.S.A.	18" Uniroyal	1500'	Baytown Refinery
	36" Uniroyal	1200'	Baytown Refinery
Texas Pipe Line Co.		600'	Houston
Texaco, Inc.		200'	Orange
		500'	Galena Park
		6500'	Port Arthur

2. Skimmers & Vacuum Equipment

A. Mississippi River Delta Area

Operator	Vacuum Eqpt. or Pumps	Skimmer	Type	Location
Exxon Company U.S.A.	Jaeger (4)		1½"Pump	Lake Washington
		Acme	Skimmer pump	Lake Washington
		Westerman(2)	Oil Skimmer	Lake Washington
	Jaeger (2)		2" Pump	Potash
	Jaeger (2)		2" Pump	Southeast Pass
Gulf Oil Company U.S.	Acme Saucer type skimmer pump			Bayou Couba
	Water Master Saucer type skimmer pumps			Grand Bay
	Swiss type skimmer			Quarantine Bay
	12' x 28' self propelled oil skimming barge			Quarantine Bay
	Skimmer (field fabricated 14' x 36' x 5')propelled by work barge			Quarantine Bay

A. Mississippi River Delta Area (continued)

Operator	Vacuum Eqpt. or Pumps	Skimmer	Type	Location
Gulf Oil Company U.S.	Skimmer (field fabricated 14' x 36' x 5')propelled by work barge			Black Bay
		1	14' x 36' self-propelled	W. Bay office & Whs.
	1		Watermaster skimmer pump	W. Bay office & Whs.
	2		Manual roller wringers	W. Bay office & Whs.
	1		Manual roller wringers	Southeast West Bay
	1		Manual roller wringer	North West Bay
	1		Manual roller wringer	Bastian Bay
	Water Master Skimmer	2	Floating saucer type	Delta Gathering Station
		2	Acme floating saucer	Venice
			Skimmer pump unit w/3½" alum. Discharge tube & 39" Urethane filled float ring w/150' of 4" nylon heavy duty hose & connections	Ostrica
Hunt Oil Company		1	Water master	Dixon Bay
Phillips Petroleum Company		1	Float skimmer Model 3SK-FS 200 GPM	Buras, La.

A. Mississippi River Delta Area (continued)

Operator	Vacuum Eqpt. or Pumps	Skimmer	Type	Location
Placid Oil Company	(2) 3" x 3" Cent. pumps (1) 2" x 2" Cent. pumps (6) 2" Diaphram pumps	1	Home made	Lake Washington
Shell Oil Company			(1) Shell oil scoop	Venice
			(1) 24" Swiss Olea 111 skimmer	Venice
			Skimmer pump 700 GPM	East Bay
Texas Pipe Line Co.			1 - 3½" floating saucer pump	Harvey
Texaco, Inc.			1 - 3 HP skimmer	Garden Island
Chevron Oil Co.		3	Shell	Venice Base
		1	Barge Mounting	Venice Base
		1	36" Floating	Romere Pass
		10	AK	Venice Base
	3		Double Diaphram Skimmer Pumps	Barataria
	1		Acme Skimmer pump	Delta Farms
	2		35 Bbl Capa. Vacuum Trucks complete w/skimmers	Pascagoula Ref.
	1		Port. Floating Saucer Pump Skimmer	Pascagoula Ref.

B. Grand Isle - LaFourche - Terrebonne Area

Operator	Vacuum Eqpt. or Pumps	Skimmer	Type	Location
Amoco Production Company			Acme skimmer w/4 HP engine and 150' of 4" hose	Valentine Field
Continental Oil Company	15 HP skid - Deutz vacuum pump 5 HP Diesel - Diaphram pump			
Exxon Company - U.S.A.		Acme (2)	Saucer	Pelican Island
		Acme	Saucer	Grand Isle
	Suction Boom		Hale Pump	Pelican Island
	Jaeger (2)		Pump	Breton Canal
		(2)	3½" Saucer	Destrehan Terminal Harvey
	Jaeger		2" Skiff	Lirette
	Jaeger		3" Pump	Lirette
	Jaeger		2" Pump	Paradis
			3½" Saucer Skimmer	Thibodaux
	Jaeger (2)		2" Pump	Thibodaux

B. Grand Isle - LaFourche - Terrebonne Area

Operator	Vacuum Eqpt. or Pumps	Skimmer	Type	Location
Gulf Oil Company - U. S.		1	Acme floating saucer Skimmer pump unit w/3½" alum. discharge tube and 39" urethane filled float ring w/150' of 4" nylon heavy duty hose and connectors	Leeville
		1	Parker oil hawg	Timbalier Bay
		1	Acme tunnel skimmer	Bully Camp
		1	Self-propelled skimmer barge	Timbalier Bay
	Equipment stored at Timbalier Bay, Bully Camp Field, and Leeville inventoried by the Houma Area is available for use by the Morgan City Area Onshore Facility.			
Ocean Drilling & Exploration Company		1	High volume open sea skimmer	Grand Isle
Shell Oil Company			(2) Acme FS-3	Chauvin & Gibson
			Portable 3x3 cent pump (5 HP Gas)	LaPice

B. Grand Isle - LaFourche - Terrebonne Area

Operator	Vacuum Equp. or Pumps	Skimmer	Type	Location
Shell Oil Company (Cont'd)			Portable 3x3 (5HP Gas)	St. Gabriel
Texas Pipe Line Co.	1 - Centrifugal Pump			Cocodrie
	1 - Centrifugal Pump			Golden Meadow
		2 - 3 HP skimmer pumps		Bay de Chene
Texaco, Inc.	1 - Fire Pump			Lake Barre
	1 - Fire Pump			Lake Pelto
	2 - 2" Centrifugal pumps			Leeville
	1 - Fire pump			Leeville
	1 - Fire pump			Caillou Island
	1 - Fire pump	1 - 3 HP skimmer pumps		Bay St. Elaine
	2 - 2" Centrifugal pumps			Dog Lake
	1 - Fire pump			Dog Lake
	2 - 2" Centrifugal pumps	1 - 3 HP Skimmer pump		Golden Meadow
	1 - Fire pump			Golden Meadow
Union Oil of California		1	Floating skimmer	Dulac Offshore Base
		1	Floating skimmer	Caillou Island S/L 2826
Chevron Oil Co.		1	Don Wilson	Leeville

C. Morgan City - Atchafalaya Area

Operator	Vacuum Eqpt. or Pumps	Skimmer	Type	Location
Cities Service Oil Co.		1	Model FS 400-ASK 4" float w/gas engine 100'-4" hoe w/couplings elbows and floats	Lawson Field (Crowley, La.)
Exxon Company U.S.A.			Skimmer pump w/26" float	Bayou Salle
			Skimmer pump w/26" float	Avery Island
			Skimmer pump w/26" float	Duck Lake
			Skimmer pump (dble. acting gas or air diaphram)	Bayou Salle
			2x2 Gas Engine driven pump	Bayou Salle
			(5) 14' Alum. boats	Duck Lake
	Jaeger (2)		2" Pump	Morgan City
			Skimmer Pump	Morgan City
Occidental Petroleum Corp.	Water Master 20' 6" Discharge	1	Float Type	Simon Pass Fld.
Shell Oil Company			(2)Portable vacuum (3 HP Gas) Pump	Bayou Sorrel Unit
			Float skimmer Model 3SK-FS	Weeks Island
			Float Skimmer (3HP)	West Lake Verret Ut.
			Portable centrifugal pump	
Chevron Oil Company		2	AK	Morgan City

C. Morgan City - Atchafalaya Area

Operator	Vacuum Eqpt. or Pumps	Skimmer	Type	Location
Texas Pipe Line Co.	1 - 2"Pump 2 - 2"Pumps	1 - floating saucer pump		Erath New Iberia
Texaco, Inc.		1 - 3 HP floating saucer pump		Bayou Sale
Union Oil of California		1	Floating skimmer	EI Blk. 32

D. Vermilion - Cameron Area

Operator	Vacuum Eqpt. or Pumps	Skimmer	Type	Location
Exxon Company U.S.A.			Oil skimmer (drum type) 17' Inboard-Outboard alum. boat. Wisconsin's Jaeger pump	Intracoastal City Intracoastal City Intracoastal City
Phillips Petroleum Co.		1	Float skimmer Model 3SK-FS 200 GPM	Cameron, La.
Shell Oil Company			(2) Float skimmer Model 3SK-FS Portable Vacuum Pump (3 HP)	Black Bayou Ut.

E. Texas Gulf Coast Area

Operator	Vacuum Eqpt. or Pumps	Skimmer	Type	Location
Exxon Company U.S.A.		(6)	Air driven Skimmer pumps	Baytown Refinery
Texaco, Inc.		1 4 HP floating skimmer		Orange, Texas
Chevron Oil Co.		1	Floating	Padre Island
**		1	Floating	Cedar Point

3. Spraying Equipment

A. Mississippi River Delta Area

Operator	Type	Capacity	Location
Exxon Company U.S.A	2" Hale Fire Pump (2)		Lake Washington
	2½" Hale Pump		Southeast Pass

B. Grand Isle - Lafourche - Terrebonne Area

Operator	Type	Capacity	Location
Exxon Company U.S.A.	Hale pumps with proportioning device	200 GPM	Grand Isle
	Hale pump (2)		Brenton Canal
	B. J. Pump		Brenton Canal
	2½"Hale Fire Pump (3)		Lirette
	2½"Hale Fire Pump		Paradis
	2½"Hale Fire Pump		Thibodaux
**			
Chevron **	1-Wheel mounted 3" Diesel pump w/hose		Barataria
	4-1-1/2" Hale fire pumps w/hoses		Barataria

C. Morgan City - Atchafalaya Area

Operator	Type	Capacity	Location
Exxon Company U.S.A.	Hale Fire Pump - Trailer Mounted Trailer Mounted - Self Contained	150 gal.	Morgan City Bayou Salle
Mobil Oil Corporation	Bean (Portable)	200 gal.	M. C. Yard (Morgan City)
	Spray Boom		M. C. Yard (Morgan City)
Occidental Petroleum Corp.	MP - Great Type Pump 1-1/4 x 1-1/4	1-1/2 bbl/min.	Simon Pass Field

D. Vermilion - Cameron Area

Operator	Type	Capacity	Location
Shell Oil Company	John Bean Spray Pump	150 gals.	Black Bayou Unit

E. Texas Coast Area

NONE

4. Absorbents

A. Mississippi River Delta Area

Operator	Type	Quanity	Location
Exxon Company U.S.A.	Sorbent "C"	30 sacks	Potash
Gulf Oil Company U.S.	Conwed Blanket	20 rolls	Black Bay
	Conwed Blanket	20 rolls	Quarantine Bay
	Conwed Blanket	15 rolls	Grand Bay
	Conwed Blanket	5 rolls	Bayou Couba
	Oil Mops	7	West Bay Office & WH
	Oil Mops	5	Southeast West Bay
	Oil Mops	10	North West Bay
	Oil Mops	5	Bastian Bay
	Helicopter deployable kit-3'x2'x4' containing 200' OCW2-6 rope mop 1 - 4" manual wringer 1 - floating tail pulley	1	Venice
	22# drums, Pittsburg Corning sea beads	20	Venice
	18# bags, oil blotter absorbent	24	Venice
	15# bags, oil blotter absorbent	8	Ostrica
	25# bags, Anderson ground corn cobs	12	Venice
	25# bags, Anderson ground corn cobs	7	Ostrica
Placid Oil Company	Fiber Pearl	35 sacks	Lake Washington
Shell Oil Company	Hay, Straw or Bagasse	300 bales	East Bay Field
		100 bales	Empire Field
		150 bales	Block 69 Field

B. Grand Isle - Lafourche - Terrebonne Area

Operator	Type	Quanity	Location
Amoco Production Company	Hay	20 bales	Lake Long Field
	Hay	25 bales	Lake Raccourci Fld.
	Hay	15 bales	Valentine Field
	Hay	50 bales	Lake Boeuf Field
	Fiberperl Sorbent	3 sx	Lake Boudreaux Fld.
	Fiberperl Sorbent	14 sx	Lake Boeuf. Field
Exxon Company U.S.A.	Hay	80 bales	Mayronne Mud Co.
	Cottom seed hull	50 sacks	Grand Isle
Gulf Oil Company U.S.	25# sacks, Anderson Ground Corn Cobs	10	Leeville
	(Propose purchase following:) Conwed Sorbent Pads	(2) boxes	Bay Marchand Onshore Facility
	Jimbeaux Oil Mop	2	" "
Placid Oil Company	Conwed Sorbent Pads	5 boxes	Chauvin
Skelly Oil	Conwed Sorbent Pds 18"x18"x¼"	1,760	Coon Point Onshore Facility, mouth of Grand Bayou DuLarge

C. Morgan City - Atchafalaya Area

Operator	Type	Quanity	Location
Mobil Oil Corporation	Absorbent - C - (Two hand skimmers to pick up absorbents)	35 bags	Morgan City - Loading Dock

C. Morgan City - Atchafalaya Area (continued)

Operator	Type	Quantity	Location
Occidental Petroleum Corp.	Conweb	1000#	Simon Pass Field

D. Vermilion - Cameron Area

Operator	Type	Quantity	Location
Gulf Oil Company	Proposed purchase as follows:		
	Conwed Sorbent Pads	(2) boxes	W.C. Blk. 45 Onshore Facility
	Jimbeaux Oil Mop	2	W. C. Blk. 45 Onshore Facility
Shell Oil Company	Hay, Straw or Bagasse	10 bales	Weeks Island Field
		10 bales	Black Bayou Field

E. Texas Coast Area

NONE

APPENDIX D

OFFSHORE OIL AND GAS OPERATIONS

A. A Description of Oil and Gas Operations

1. Geophysical Exploration

a. Industry

In order to locate hydrocarbon deposits, the oil industry must analyze the substructure of the continental shelf and slope. The prime objective of the structural analysis is to locate geologic features, such as local upwarping of the sediments, faulted structures and piercement salt and/or shale domes, which are favorable for the accumulation of petroleum. A knowledge of the subsurface geologic environment is also necessary to detect near surface conditions, such as recent faulting or high pressure zones, which are potential hazards to exploration and production operations. Once hazardous conditions are identified, drilling programs are modified to assure safety of operations.

Prior to a call of nomination of lease sale tracts, industry normally conducts regional geophysical surveys of the area of interest. These surveys provide a network of modern state-of-the-art common depth point (CDP) seismic lines, using approximately a 4 mile-by-4 mile grid spacing to provide data for reconnaissance mapping. In some cases (an even closer) 2 mile-by-2 mile line spacing may be used. After the Department issues a call for nominations, industry initiates the collection and interpretation of even more detailed

seismic data in order to evaluate potentially productive tracts, and to formulate reasonable bid offers.

In seismic exploration, a survey vessel travels along a predetermined path, guided by a sophisticated electronic navigational system and towing seismic signal generating and recording equipment. The signal generated by the energy source is a series of small amplitude seismic pulses that travel at the speed of sound through the water and sediments below, where they are reflected and refracted by the underlying strata. An array of sensitive detectors (hydrophones) towed by the vessel record incoming seismic waves on magnetic tape. After extensive processing, these recordings are displayed in the form of vertical cross sections. These seismic profiles are interpreted to identify those areas where the sediments are arched, faulted or pierced by salt or shale domes, where they thicken or thin, and where reef structures occur. By assembling cross sections, run in various directions, a three-dimensional picture can be constructed, indicating the location, size and form of geologic structures favorable for oil and gas accumulation. This information is normally displayed in the form of subsurface seismic contour maps.

In the early years of offshore exploration, the energy source for the seismic wave was explosive charges detonated in the water layer. Because of the hazards associated with the use of dynamite to the seismic vessel, crew and natural marine life, new equipment and methods that evolved within the last five years and now account for

well over 95% of marine seismic activity. [1]

In particular, the use of a vibrator system, sparkers, air guns and gas guns now provide excellent seismic data with no observed harmful effect on the marine environment.

In addition to the deep penetration CDP seismic reflection data, some companies purchase and interpret shallow penetration high resolution geophysical data to locate potential geologic hazards such as unstable bottom sediment conditions and fault zones. A typical high resolution data acquisition system is illustrated in Fig. 1. The possibility of three types of geologic hazards exist in the Gulf of Mexico. The first hazard is the blowout caused by the presence of shallow gas above 1,000 feet in depth. The second hazard is from high pressure zones which can occur by penetrating an under-compacted deep water shale. The third hazard occurs from unstable sea floor. The soft, plastic sea floor sediments and surficial faults do not provide a stable foundation for drilling structures.

b. U. S. Geological Survey

Deep Seismic Information: The USGS has acquired, from industrial sources, a large quantity of modern seismic (CDP) data in the Gulf of Mexico to support the Federal offshore leasing program. These data will provide definitive information on the size,

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1/ Taken from Testimony of E. O. Bell, past President, Offshore Operators Committee, presented at OCS Public Hearing, Houston Texas, February 22, 1973.

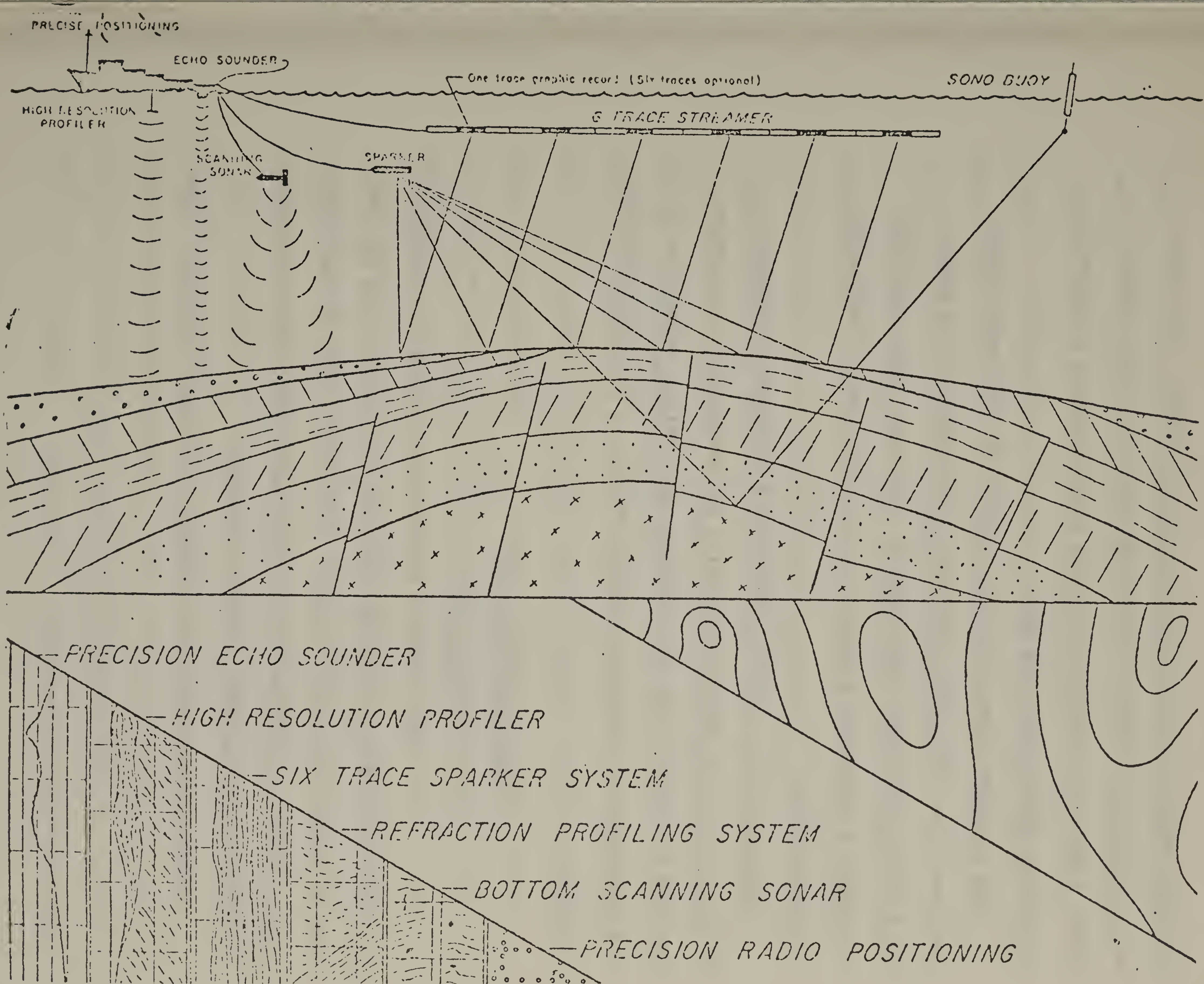


Figure 1. Geophysical and Seismic Data Collecting (from exhibits of Henry A. Hill, OCS Public Hearing at New Orleans, La. Aug. 23, 1972)

shape and depth of the prominent structural features. The structural attitude of subsurface beds from depths of 2,000 to over 20,000 feet can be mapped to show the relative merits of potential structural traps for oil and gas.

The type structures which are expected are salt and/or shale piercement-type structures, deep-seated salt and/or shale domes and features associated with extensive faulting. These structural features are considered favorable for the migration and entrapment of hydrocarbons.

High resolution, shallow sub-bottom information: Geophysical data which show the shallow structural and sedimentary environment, are used to predict, and thus minimize, any geologic hazards to drilling operation and consequent possible dangers to the environment from pollution.

2. Exploratory Drilling

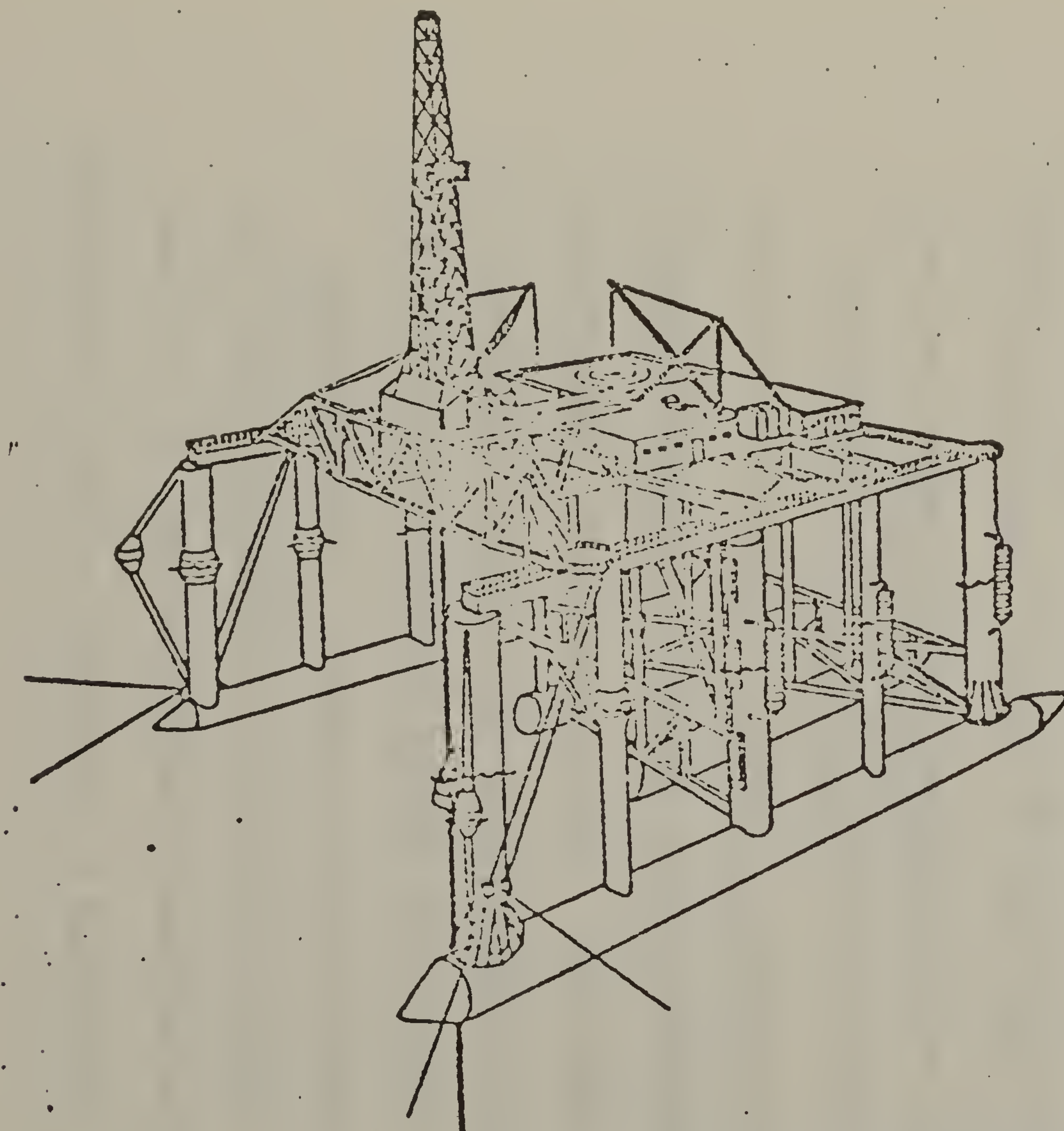
a. Drilling phase

Most offshore exploratory drilling is accomplished with the use of mobile drilling rigs that can be moved from one location to another with relative ease. These mobile rigs include those that are bottom-supported while drilling and those floating rigs that are held in position over the site by anchors.

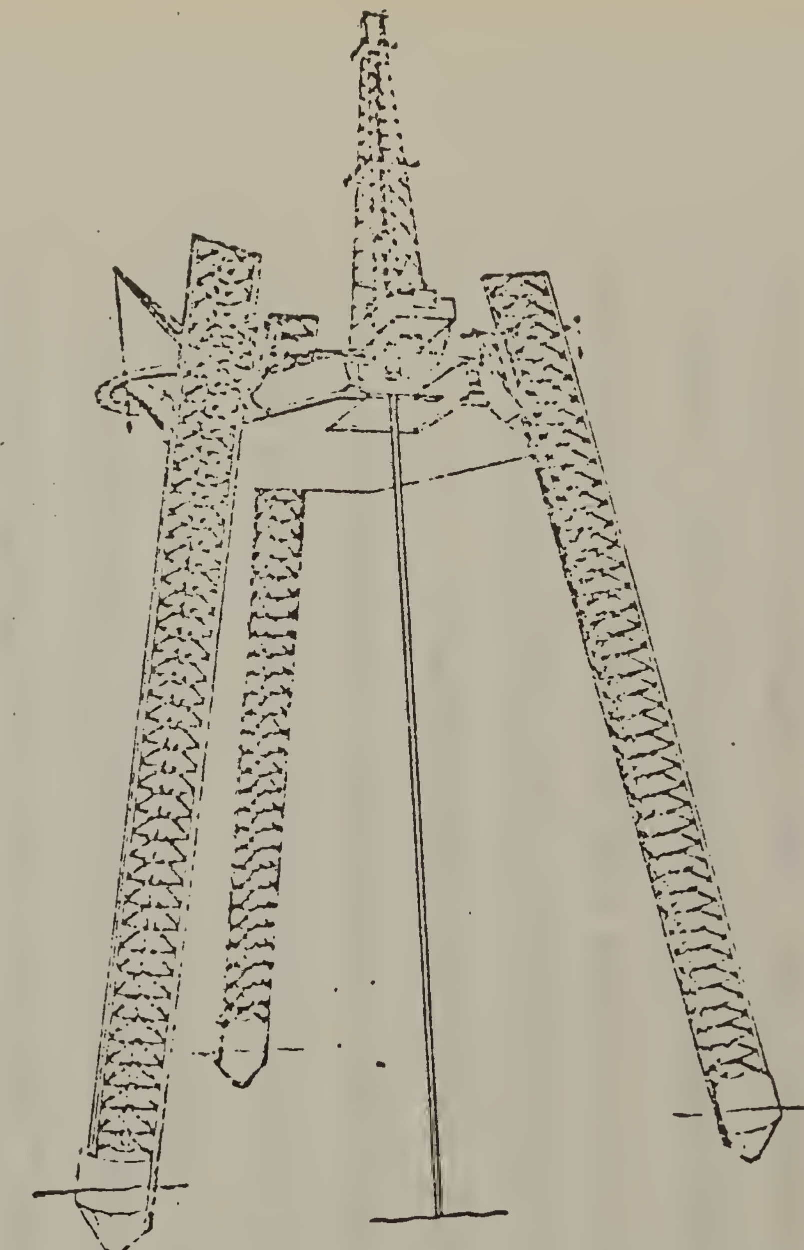
Shallow (less than 200 feet) water exploratory drilling is com-

monly conducted using bottom-supported rigs of the "jack-up" (Fig. 2) and submersible (not pictured) types. The submersible drilling rigs normally operate in water depths to approximately 70 feet. Most "jack-up" bottom-supported drilling rigs are towed by tugboats from one location to another while in a floating position, whereas some are self-propelled and do not require tug assistance.

The semi-submersibles (Fig. 2) are large, advanced-design floating rigs that can work in water depths up to 1,000 feet and beyond, and have better motion characteristics in rough seas than do ships or barges. These rigs are floated to the site, partially submerged, and held in place by anchors. The major problem encountered during the use of floating and semi-submersible drilling vessels is keeping them properly aligned with the drill hole on the sea floor. Winds, waves and ocean currents tend to push them off location regardless of how good the mooring system. One solution has been to connect the wellhead (on the sea floor) with the drilling rig by a drilling riser pipe which is tensioned at the top to maintain its structural integrity. The tension requirements can be reduced by attaching buoyant material to the riser. High seas, strong currents and heavy weather, however, can still cause the rig to drift off location, putting excessive stresses on the riser. One company's solution to this problem is the use of an acoustic position reference system whereby acoustic signals from a beacon located near the wellhead on the sea floor are received by three shipboard hydrophones (Fig. 3). In use, the vessel's position is determined by comparing, at each of the three



Once anchored in place, the semi-submersible is used to drill wildcat or exploratory wells in depths up to 1,000 feet and beyond.



With elevating legs, the jack-up rig can be floated to location and then raised or jacked up on the legs to appropriate height above water. This rig is normally limited to about 300-foot water depths.

Figure 2 - Exploratory Drilling Rigs (From "The Offshore Search for Oil and Gas Exxon Background Series No. 2R, November, 1972).

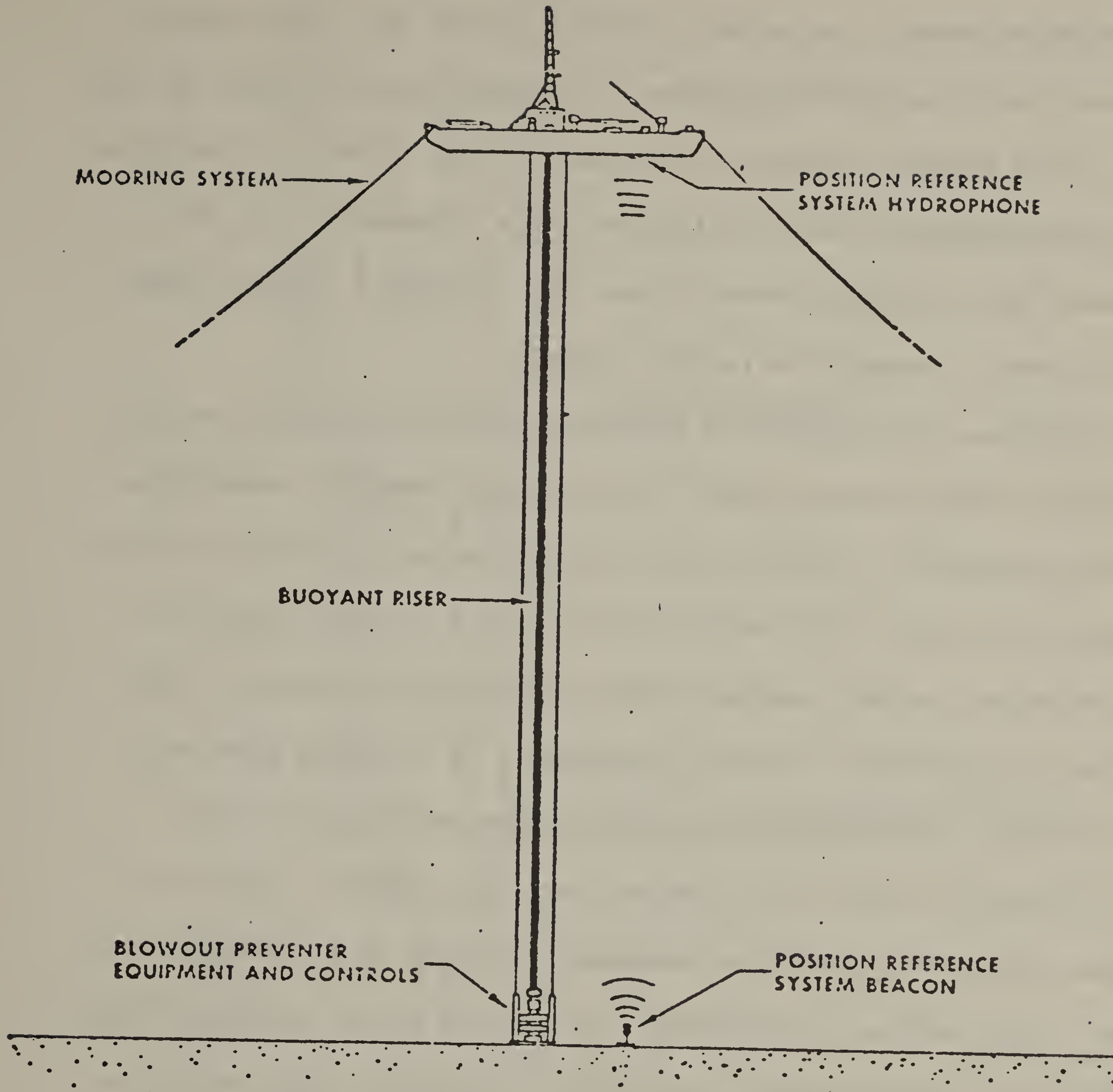


Figure 3. Components of a Deepwater Exploratory Drilling System
(From Deepwater Capabilities ESSO Production Research Company.)

shipboard hydrophones, the signals emitted by the sea floor beacon. The correct position, with reference to the wellbore, is shown on the drilling rig's console viewing screen and the rig is kept in position by adjusting mooring lines or using the rig's thrusters. If, for some reason the rig should have to move off location, the sea floor beacon is used to reposition it upon return.

In drilling, two distinctly important pressures must be considered. One is the pressure within the geologic formation penetrated (formation pressure), and the other is the pressure required to fracture and/or force any fluid which may be in the wellbore into the formation below the last casing string (breakdown pressure). These pressures are naturally occurring phenomena. A drilling plan calls for maintaining a hydrostatic gradient in the wellbore that will prevent formation fluids from flowing into the wellbore and, at the same time, will not exceed the breakdown pressure of any uncased formations. This is done by adjusting the density of the drilling fluid or "mud" that is continuously circulated through the drill string to provide pressure control, lubrication of the drill bit, and circulation of wellbore cuttings out of the hole (Fig. 4).

In spite of considerable research, it is still not always possible to predetermine, particularly for wildcat wells, the formation pressure and breakdown pressure that will be encountered. During drilling there are several means of determining the trend in pressure. They include measurements such as formation temperature (as reflected by the temperature of the returning mud), shale density and changes in

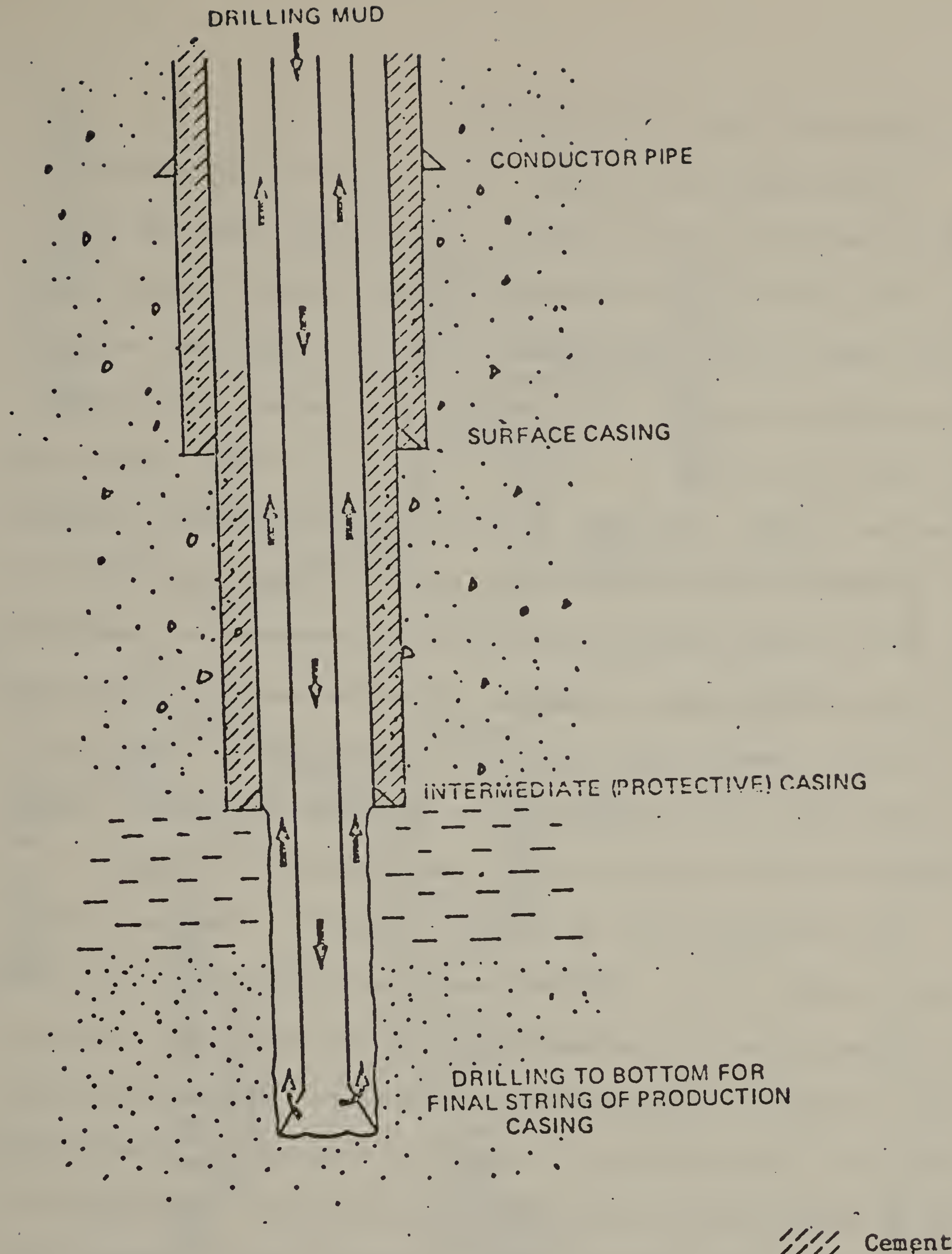


Figure 4 . The drilling mud circulates down through the drill pipe and up the annulus. The relation between the mud pressure gradient and the formation fracture gradient is critical.

(Adapted from Panel on Operational Safety in Offshore Resource Development, "Outer Continental Shelf Resource Development Safety," Marine Board of National Academy of Engineering, Dec.,

the penetration rate of the drill bit.

If the hydrostatic gradient of the drilling fluid becomes less than formation pressure, a "kick" of gas or other fluid may flow into the wellbore from the formation being drilled. The influx displaces some drilling fluid, thereby causing an additional reduction in the hydrostatic head in the annular space between the drillpipe and the borehole (Fig. 5). If the volume of the influx is not excessive, and surface indication (increased mud tank volume) is observed, the unwanted influx of fluid or gas can be circulated out of the well by careful observation and control of well conditions and adherence to preplanned emergency procedures. From the record of a kick, the bottom-hole pressure can be determined accurately, and with this pressure known, the mud weight can be increased to provide a sufficient hydrostatic head for the safe continuation of drilling.

An uncontrolled kick is called a "blowout". Blowouts seldom occur but when they do, they can usually be brought back under control by implementation of preplanned emergency procedures and actuation of devices known as "blowout preventers" which are mounted on every offshore well during drilling. A simplified diagram of a blowout preventer is shown in Fig. 6. Actual blowout preventers used offshore contain at least three types of rams. A typical blowout preventer system would include the following: one bag-type, one with blind-rams and one or two with pipe rams, depending on how many strings of casing have been set in the bore hole. Blowout preventers are essentially large valves that can close around the drill string or across an open

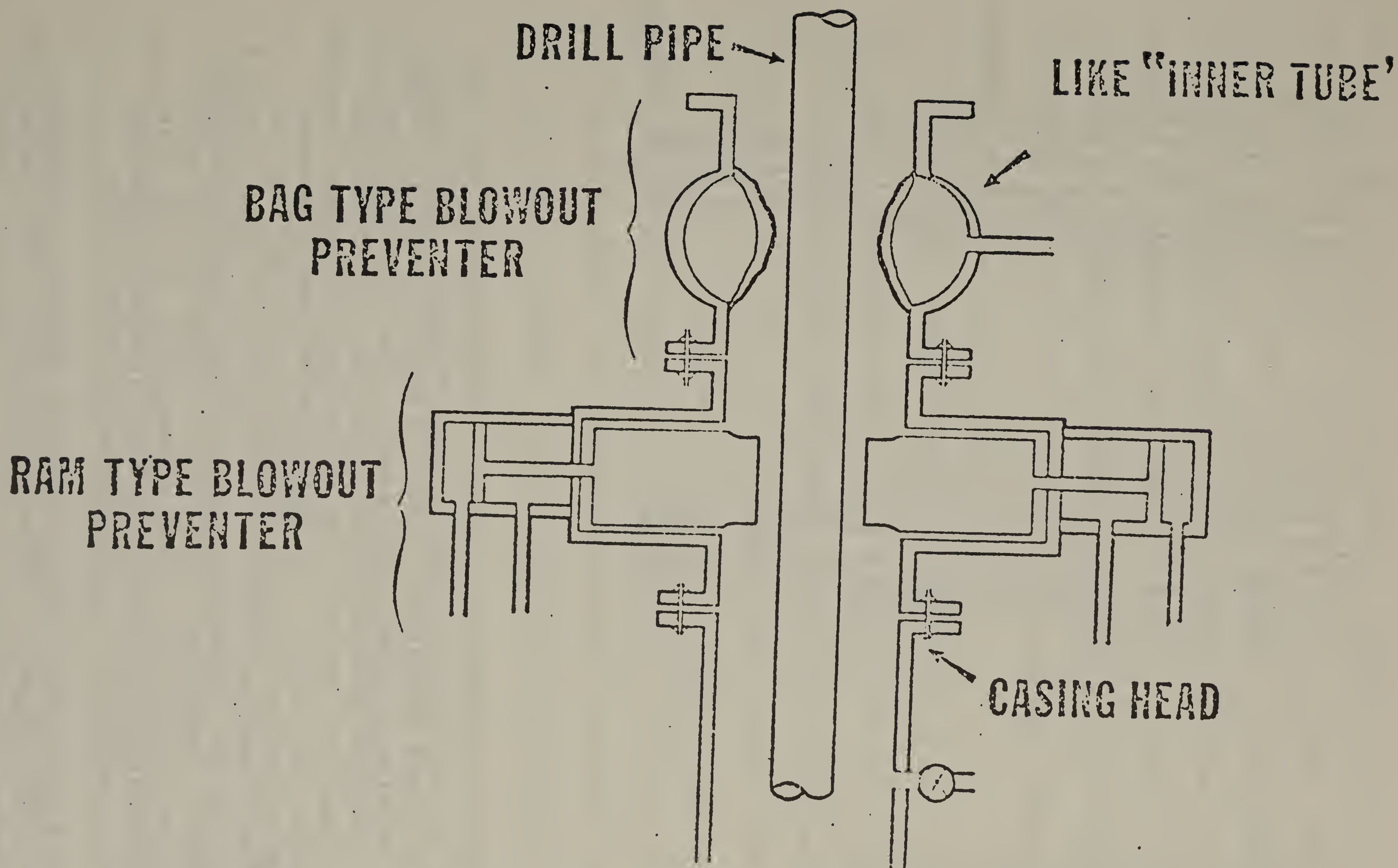


Figure 6. Bag Type and Ram Type Blowout Preventors
(From testimony of Bob G. Murphy on behalf of the Offshore Operators Committee at a public hearing in Houston, Texas, on February 22, 1973.)

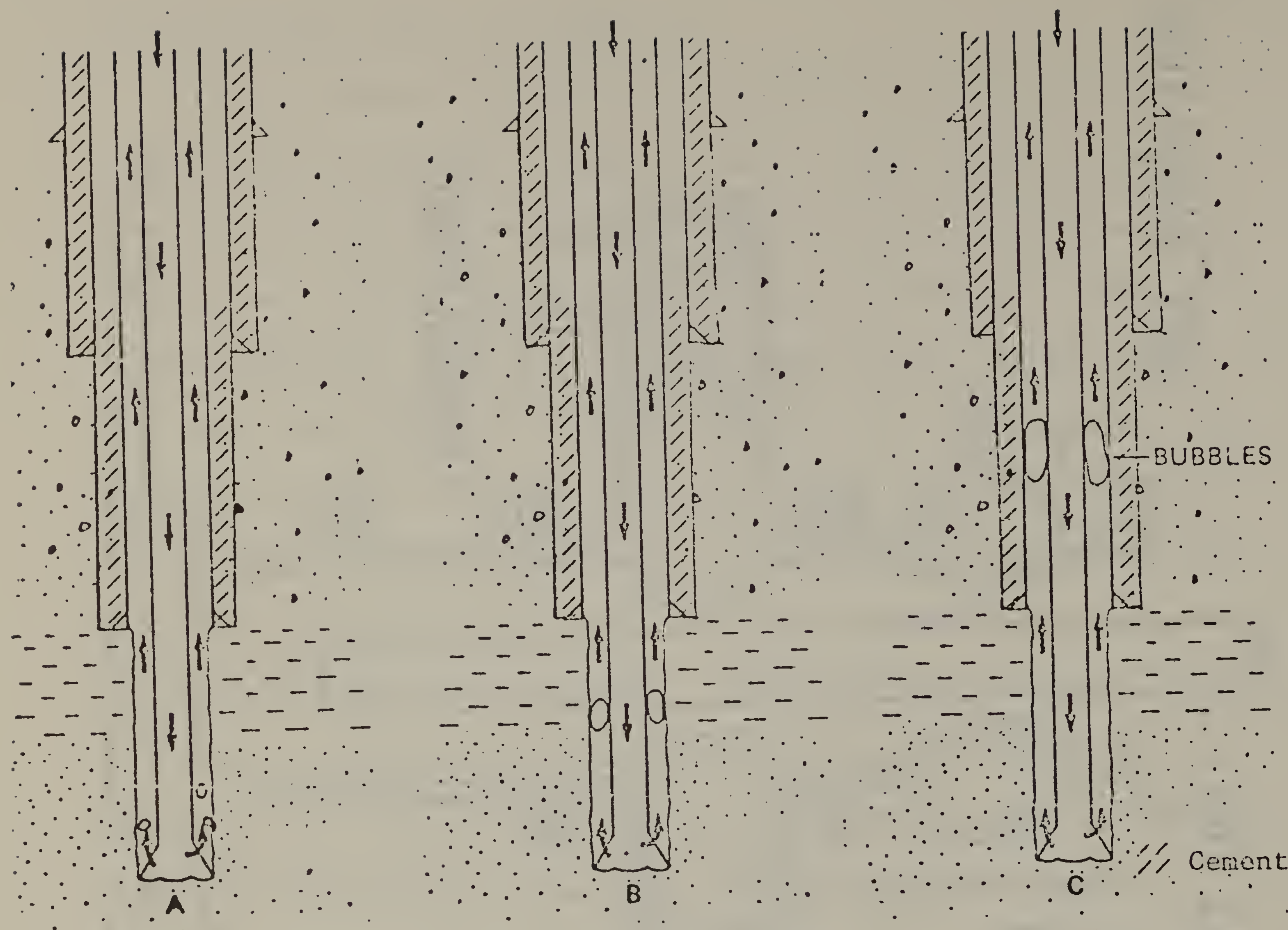


Figure 5. A "kick" is a gas or liquid influx that reduces the hydrostatic bead in the annulus. Here, the kick is a gas bubble (A), as it rises (B and C), it expands causing a sudden increase in the upflow of the mud. When the bubble reaches the top, if it has not been allowed to expand, the bottom-hole pressure reaches a maximum, the sum of mud pressure and gas pressure. This pressure maximum, if excessive, can exceed the formation fracture pressure and lead to a loss of drilling mud to the formation, thus further decreasing the hydrostatic pressure. This could cause an influx of formation fluids into other formations, or the fractured formation taking fluid from another formation commonly referred to as an underground blow-out.

(Adapted from panel on Operational Safety in Offshore Resource Development, "Outer Continental Shelf Resource Development Safety", Marine Board of National Academy of Engineering, December, 1972)

hole and seal off the well at the surface. Blowouts can occur downhole when a low-pressure formation fractures, and fluids from a higher-pressure zone flow into the fractured formation. Such underground blowouts, like surface blowouts, require the careful use of preplanned emergency techniques to regain control. Blowout preventers and other well-control equipment must meet the requirements of OCS Order No. 2. This equipment is tested on a schedule set by prudent practice, but not less often than regulations specify.

To ensure that adequate provisions have been made for safety and well control, the casing program and drilling mud program must be approved by the Geological Survey before a drilling permit is issued. Along with adequate casing, it is important that enough cement be spotted between the casing and the wall of the hole to seal off and isolate all sensitive geological formations such as hydrocarbon zones and fresh water sands, and to separate abnormally pressured zones from those with normal pressures. A prime function of the drilling mud is to maintain hydrostatic pressure control in the well, and mud is tested frequently during drilling operations to ensure that it has sufficient density and meets other physical and chemical specifications.

b. Well completion phase

Should the initial test well be dry, it is plugged with cement. One objective is to prevent the escape of formation fluids from their original reservoirs either into other formations or to the surface. When a well is abandoned, the casing is cut-off at least 15 feet below the mud line, all obstructions are removed, and

the bottom is dragged to be sure that no obstructions were overlooked. During plugging operations, well-control equipment remains in use. In some cases, it may be necessary to drill several exploratory wells on the block before the lease is finally condemned.

Fluids from formations penetrated by wells are often brought to the surface in drill-stem tests to evaluate the possibility of oil and natural gas production. These fluids are collected in tanks at the surface; drilling mud is separated from the produced fluid, and if the formation fluid is oil it is either stored for later disposition, or the oil and natural gas are flared in specialized, high volume burners.

If well tests show that commercial quantities of natural gas or oil have been found, it may be necessary to drill and evaluate several additional confirmation wells before the company is satisfied that the reserves will support installation of a drilling-production platform.

It is also important to delineate precisely the extent of the petroleum reservoir because of the great expense of deeper water platforms and the economic necessity of drilling as many production wells as possible (sometimes over 30) from a single platform. Platform location in relation to hydrocarbon deposits must be extremely accurate to minimize the number of platforms installed.

If petroleum deposits prove to be of commercial size, one of two courses of action may be followed: (1) The exploratory well may be

deemed expendable and be permanently abandoned. Procedures followed would be the same as in dry hole abandonment. (2) The well may be deemed satisfactory for future use as a production well and temporarily abandoned. In this case, a mechanical bridge plug is emplaced in the smallest string of casing and the well head capped and left for future entrance when production activity commences. This results in the temporary existence of an underwater "stub". The Coast Guard District Commander requires that such stubs be marked by a buoy at the surface if located in 200 feet of water or less, and that the buoy be lighted if located in 85 feet of water or less.

3. Development Drilling, Production and Workover [1/]

a. Platform installation and production well drilling

Offshore drilling and production operations are usually conducted on fixed, bottom-founded, water surface-piercing platforms (Fig. 7). If exploratory efforts are successful in proving a hydrocarbon reserve, production operations are initiated by installating platforms to serve as a base for drilling development wells and for subsequent production operations. A number of wells may be directionally drilled to develop a large area from a single platform. Many platforms in the Gulf today contain as many as 20-30 wells.

During the 27-year history of oil operations in the Gulf of Mexico, industry has gained a good understanding of the physical forces acting on offshore platforms. Therefore platform design is a matter of selecting the optimum geometry and sizing structure members with appropriate safety factors to withstand maximum anticipated environmental forces and operational loads. Appropriate design procedures are outlined in API Recommended Practice RP 2A and various API specifications. These guidelines have been prepared to cover engineering design and operation of offshore structures and related equipment. USGS OCS Order No. 8 defines regulatory approval

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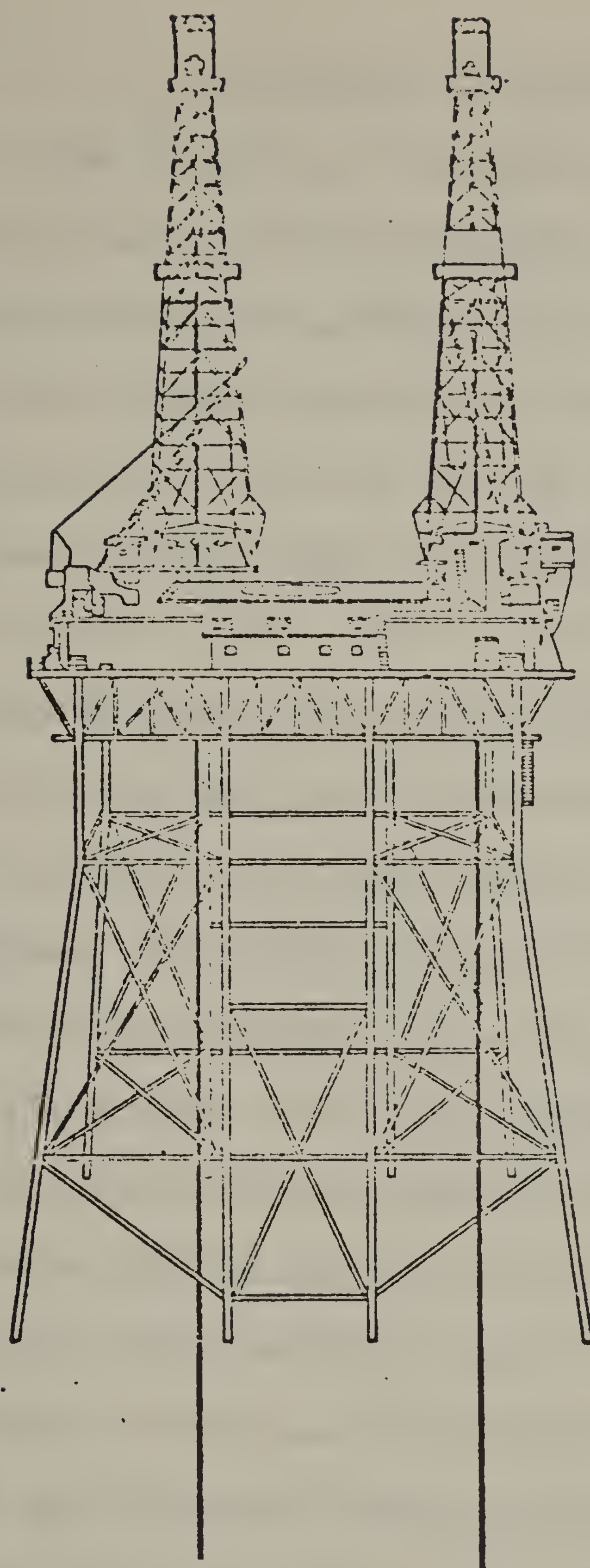
1/ Much of the information in this section has been excerpted from State of C. C. Taylor, Dept. of Interior Hearing, Louisiana Offshore Annual Sale No. 33, November 28-29, 1973.



Rigs mounted on fixed platforms, used for development drilling after an oil or gas discovery, permit drilling up to thirty wells from a single platform and location. After drilling, the rigs are removed, and the platform is used for production.

Figure 7 . Fixed Production Platform: Rigs

(from "The Offshore Search for Oil and Gas," Exxon Background Series No. 2R, Nov., 1972, Public Affairs Dept., Exxon Corp.)

procedures for platform design and installation.

Platforms have been installed in the Gulf of Mexico in water depths to 373 feet, and technology exists to extend platform operations to much greater depths. Platforms are now being fabricated for installation in the North Sea in water depths to 460 feet. A design for installation in 850 feet of water at the Santa Ynez Unit in the Santa Barbara Channel has been completed and is ready for implementation.

The primary new requirement for platforms in depths beyond current operations is for procedures to erect the platform at the offshore or floated to the offshore location for erection. During the first stage of erection, the lower portion of the platform, which extends from the ocean floor to just above the water level, is set in a vertical position on the ocean floor. Pilings are then driven through the structure legs to secure the platform to the bottom. In the second stage of erection the platform deck is installed on the supporting structure. Large platforms in deep water will require use of more and/or larger lifting, transportation and installation equipment than shallow water platforms. However, once set and secured with pilings, subsequent platform operations are identical to those that have been proven safe in current operation. No technological limitation in platform installations in water depths to at least 1000-1200 feet are apparent at this time; thus, all of the tracts proposed for this lease sale should be able to be developed in the conventional manner.

Buoyant towers have potential applications in water depths greater than about 1000 feet. These towers are pivoted at the base and are stabilized in a vertical position by buoyant chambers. Unlike conventional platforms, buoyant towers sway under the action of wave forces instead of resisting them. In waters much less than 1000 feet deep, however, the sway of these towers would be excessive. Towers that would support two drilling rigs, production equipment, and 40 to 60 wells appear feasible for water depths between 1000 and 2000 feet. One concept of such a tower is shown in Fig. 8. The drilling rig, power plants, generators, living quarters, storage sheds and other components, constructed in modular form, are added to the platform, and production well drilling commences. Equipment anticipated for use on deep water platforms is similar to that being used safely in current shallow water operations, and will be installed and operated in accordance with safe practices accumulated from industry experience. These practices form the basis of USGS OCS Order No. 8, which gives the safe practices a regulatory mandate. This order specifies multiple, redundant controls and safety devices including safety shut-in valves, high-low pressure pilots, high-low level controls, high-temperature shutdowns, gas detectors, shielded ignitions, fire prevention and detection equipment, and pressure relief systems. Drain and sump systems are also designed to collect any spillage that might occur on the platform. The sequence of drilling operations for production

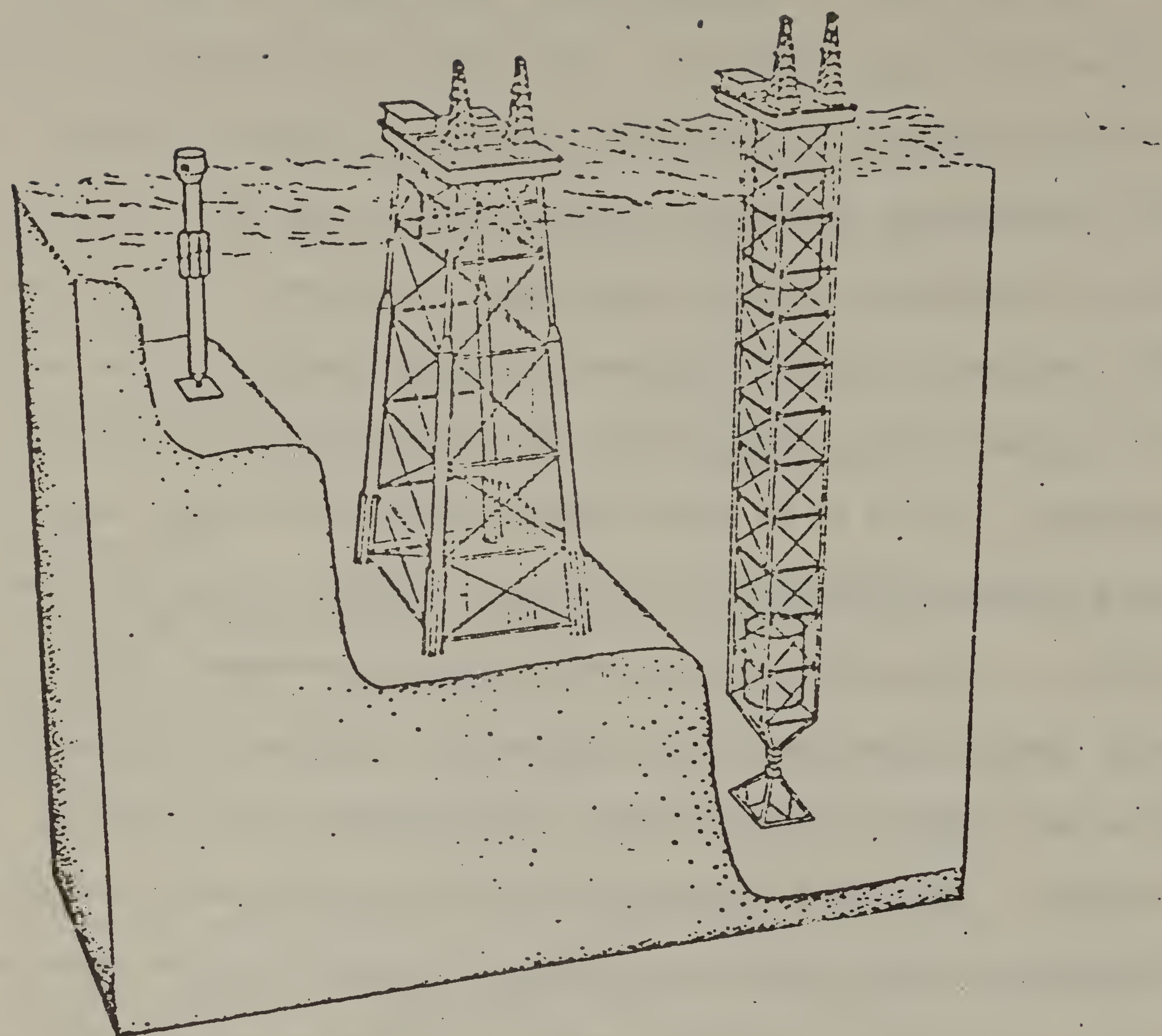


Figure 8 .French test of buoyant tower in 325 feet of water, compared with Esso concept of 700-foot platform and 1350-foot tower.

(from Deepwater Capabilities Esso Production Research Company.)

wells is essentially the same as for exploratory wells.

As water depths increase, the economic desirability of seafloor completions and, in fact, an entire subsea production system increases. Considerable progress has been made in this direction. One system allows non-divers, oil field mechanics and technicians, to work on the wellhead on the seafloor in a one-atmosphere climate by lowering them in a work chamber which can be sealed to the base of the wellhead and evacuated to atmospheric pressure. Other systems comprising complete producing facilities (pumps, separators, treater, etc.) are in various stages of development. The safety equipment used in subsea systems is similar in concept to that used in current operations and will provide the same high degree of environmental protection. The systems are designed such that a failure condition will automatically shut-in the affected part of the system. As with platform wells each subsea well will be equipped with a subsurface safety valve that can be actuated and tested on a frequent basis. Subsea completions will result in seafloor obstructions that could foul trawling gear. Only a small portion of the total trawling effort takes place at depths where subsea completions are most likely to be used. Should a trawl snag a subsea completion the possibility that it would damage any of the wellhead assembly to the extent of causing uncontrolled flow is extremely remote because of the strength and durability of the materials that would be used in the seafloor structure.

Wells usually are produced through tubing placed inside the final or production string of casing. During tubing installation, the blowout preventers remain in use to ensure control of the well. A system of in-tubing safety valves, plus other casing and tubing valves at the surface or seafloor, is installed to control well flow. Actuation is usually at the producing platform. A wellhead consisting of several redundant control valves, is installed at the platform lower deck level and subsurface safety valves are installed at depths varying from a few hundred to several thousand feet in the tubing string.

Of major concern in the operation and control of every production platform are the downhole control devices. Production tubing is fitted with one or more safety valves that are installed and located at least 100 feet below the mud line or seafloor. In the past, velocity choke valves ("storm chokes") designed to shut off production when the flow rate exceeds predetermined limits have been used. Such valves should close if surface equipment failure results in an excessive flow through the tubing. These chokes are particularly susceptible to failure from internal erosion in areas where sand is produced along with the oil and gas.

Certain types of subsurface fail-safe valves do not depend on the velocity of well fluids for actuation but are held open by hydraulic or other fluid pressure applied from the surface. The valve is designed to close automatically, shutting off the flow of fluid

from the well in the event of some undesirable situation of the platform. Essentially all wells drilled since December 1, 1972, are equipped with valves that are actuated from the surface. These valves provide highly reliable protection and may be tested frequently to insure proper operation. Their use will increase costs significantly, but the need for more reliable valves has been shown by recent incidents in the Gulf of Mexico and elsewhere. The increased degree of safety offered by use of the fail-safe valves probably justifies their installation.

Blowout preventers as well as downhole control devices have proven to be extremely valuable, in time of accidents and emergencies, in preventing large amounts of oil from escaping into the environment. When hurricanes have passed through offshore oil and gas fields, entire platforms have been swept away with only a minimal spillage of oil.

b. Drilling programs

As with exploratory drilling, the casing program and mud program for each well must be approved by the Geological Survey before a drilling permit is issued.

The following information was furnished by the Geological Survey and petroleum industry and describes the mud and casing program and cuttings generated by a representative offshore well. This well is assumed to be: a development well (not exploratory); drilled from a multi-well slot platform using a standard platform mounted rig;

a "normal" well, i.e., one in which no special drilling problems or mud problems are experienced which would cause an abnormal volume of cuttings or usage of mud (special cases are discussed later); and drilled to a total depth of 10,000 feet. (Most wells resulting from this lease sale are anticipated to have a total depth of 8,000-12,000 feet).

The representative 10,000-foot offshore well generates approximately 1,687 bbl. of cuttings weighing about 682 tons. To drill this well approximately 7,000 bbl. of seawater drilling mud containing 230 tons of mud components are used. The drill cuttings are separated from the mud by screens and discharged overboard and the mud is saved and transported for reuse at another well site.

Average drilling time is 10 to 14 days. The casing problem for this well consists of four strings: The structural casing, about 30 inches in diameter. It is set to a minimum depth of 100 feet to provide stability in unconsolidated sediments; the 16-inch conductor pipe, set at 900 feet; the 10 3/4 inch surface casing, set at 3,500 feet; and the 7-inch production string, set at 10,000 feet.

Table 1 lists the various types of drilling mud additives that may be utilized in drilling a well.

As the drilling fluid-drill cuttings mixture is circulated to the surface, drill cuttings are separated from the drilling fluid by shale shakers, desilters and desanders and discharged overboard.

Table 1

MUD ADDITIVES

Function		Name	Amount (lbs./bbl.)
Alkalinity & pH control	1.	Sodium hydroxide NaOH	0.1-0.3
	2.	Sodium bicarbonate $NaHCO_3$	0.1-1.5
	3.	Calcium chloride $CaCl_2$	0.1-3.0
	4.	Calcium hydroxide $Ca(OH)_2$	0.5-8.0
Bacteriocides	1.	Paraformaldehyde $(CH_2O)_x$	0.5-1.0
	2.	Sodium chloride NaCl	5.0-10.0
	3.	Sodium chromate Na_2CrO_4	0.1-4.0
Calcium Removers	1.	Sodium bicarbonate $NaHCO_3$	0.1-1.5
	2.	Sodium carbonate Na_2CO_3	0.5-2.0
	3.	Sodium hydroxide NaOH	0.1-3.0
	4.	Organic phosphate	0.1-0.5
Corrosion Inhibitors	1.	Calcium hydroxide $Ca(OH)_2$	0.5-8.0
	2.	Sodium chromate Na_2CrO_4	0.1-4.0
	3.	Film forming amine	2.0
Defoamers	1.	Aluminum stearate $[CH_3(CH_2)_{16}COO]_3Al$	1.0-10.0
	2.	Alkyl aryl sulfonate	0.2-0.3
	3.	Silicones	0.1-3.0
Emulsifiers	1.	Calcium lignosulfonate	1.0-4.0
	2.	Oxethylated alkyl phenol	0.5-3.0
	3.	Ferrochrome lignosulfonate	0.1-2.0
	4.	Quebracho	0.2-5.0
Filtrate Reducers	1.	Bentonite	5.0-10.0
	2.	Sodium carboxynethlyl	0.1-1.5
	3.	Sodium polyacrylate	1.0-3.0
	4.	Starch	2.0-8.0

Table 1 (cont'd)

Function	Name	Amount (lbs./bbl.)
Flocculants	1. Acrylamide polymeric hydrolite	..005- .01
	2. Bentonite	1.0 -5.0
	3. Lignosulfonate	1.0 -5.0
Foaming Agents		
	1. Alkyl polyoxethylene	8.0-16.0
Lost Circulation		
	1. Cottonseed hulls	3.0-25.0
	2. Cane fibers	2.0- 6.0
	3. Asbestos	2.0- 6.0
	4. Cellophane	5.0-10.0
	5. Mica	2.0-10.0
Lubricants		
	1. Oxidized asphalt	3.0-6.0
	2. Carbon powder	1.0-2.0
Shale Control Inhibitors		
	1. Oxidized asphalt	3.0-6.0
	2. Calcium hydroxide	0.5-8.0
	3. Sodium silicate	0.1-3.0
	4. Calcium lignosulfonates	0.1-3.0
Surface Active Agents		
	1. Oxyethylated alkyl phenol	0.5-3.0
	2. Alkyl aryl sulfonate	0.2-0.3
Thinners & Dispersants		
	1. Sodium tetraphosphate $Na_6P_4O_{13}$	0.1-0.2
	2. Calcium lignosulfonate	1.0-4.0
	3. Sodium chromate Na_2CrO_4	0.5-3.0
	4. Quebracho	1.0-10.0
Viscosifiers		
	1. Bentonite	1.0-5.0
	2. Asbestos	2.0-6.0
	3. Sodium carboxymethly cellulose	0.1-1.5

In areas of fragile or unique environments, stipulations are prepared to require drill cuttings, sediment laden fluids, wash waters, etc. to either be barged ashore for disposal or dumped down a stand pipe to an appropriate depth.

In the representative 10,000-foot well being considered here, approximately 7,000 bbl. of seawater drilling muds are used during drilling. About 1,500 bbl. of commercial mud components and 5,500 bbl. of seawater are used to make up and maintain the gelled seawater and ferrochrome lignosulfonate muds used for the well. Conditioning of the mud system in order to maintain the desired mud characteristics requires some overboard discharge of mud and an addition of commercial mud and seawater to the system daily.

The top 900 foot section of the well is drilled with a natural mud system which is a mixture of seawater, attapulgite clays, natural mud and clays from the surface formations that are drilled. Shaled particles and sand are discharged overboard as this section of the hole is drilled.

Prior to installation of the 16 inch conductor pipe in the hole, a gelled seawater mud is mixed and circulated into the well bore, and the natural mud system is discharged overboard. This gelled seawater mud is used to drill the next 2,600 feet of hole. Table 2 shows the weight and various components used to make up and maintain the required characteristics of the mud while this interval is drilled. A total volume of 700 bbl. is made up and maintained in the system.

When drilling is resumed after setting 10 3/4" casing, the mud system is altered to a lignosulfonate type (Table 3) and the volume is increased to 950 bbl. in order to allow drilling of the final 6,500 feet of hole. After the 7 inch production string of casing is set, the mud in the tanks is saved for use in drilling the next well. After the final well is drilled, all mud is generally barged ashore for recovery of chemical components or storage. Occasionally, when transport to shore storage facilities is not feasible, the unweighted components (whole mud less barite) are discharged overboard. The high cost of barite and other chemical additives makes their recovery economically desirable, however, and tends to keep overboard disposal at a minimum.

Special cases: Occasionally, abnormal formation pressures, exceptionally tight formations, or other problems require the use of oil-based or highly treated drilling muds. Drill cuttings are then separated and cleared of entrained oil before being discharged overboard, and the drilling muds are retained and shipped to shore and stored in tanks for future use.

c. Production operations

Downhole safety devices: Wells usually are produced through tubing placed inside the final or production string of casing. During tubing installation, the blowout preventers remain in use to ensure control of the well. A system of in-tubing safety valves, plus other casing and tubing valves at the surface or seafloor, is installed at the platform cellar deck level and subsurface

Table 2

GELLED SEAWATER MUD - TYPICAL COMPOSITION

Mud Component Used	Weight, lb.
Attapulgite Clay	56,300
Caustic (Sodium hydroxide)	5,500
Organic Polymer	3,700
Ferrochrome Lignosulfonate (Iron-2.6%, Chromium-3.0%, Sulfur-5.5%)	3,300
Pregelatinized Starch	500
Seawater	As required
Total Mud Components	69,300

Table 3

LIGNOSULFONATE MUD - TYPICAL COMPOSITION

Mud Component Used	Weight, lb.
Barium Sulfate (weighting agent)	319,000
Caustic (Sodium hydroxide)	22,500
Ferrochrome Lignosulfonate (Fe-2.6%, Cr-3.0%, S-5.5%)	29,600
Organic Polymer	4,100
Bentonite Clay in freshwater, or Attapulgite Clay in seawater	17,100
Proprietary Defoamer	325
Water	As required
Total Mud Components	392,625
Total Mud Components, less barium sulfate	72,625

safety valves are installed at depths varying from a few hundred to several thousand feet in the tubing string.

Of major concern in the operation and control of every production platform are the downhole control devices. Production tubing is fitted with one or more safety valves that are installed and located at least 100 feet below the mud line or seafloor. In the past, velocity choke valves designed to shut off production when the flow rate exceeds predetermined limits have been used. Such valves should close if surface equipment failure results in an excessive flow through the tubing. These chokes are particularly susceptible to failure from internal erosion in areas where sand is produced along with the oil and gas.

Newer types of valves do not depend on the velocity of well fluids for actuation, but are held open by hydraulic or other fluid pressure applied from the surface. Release of this pressure by a control signal, or by an accident, causes them to close immediately. Their use increases costs significantly, but the need for more reliable valves has been shown by recent incidents in the Gulf of Mexico and elsewhere. The Environmental Protection Agency has noted, and we agree that reliability of velocity actuated subsurface safety devices has been very low in recent disasters (11 out of 22 wells failed in the Bay Marchand fire). It is hoped that the newer pressure-release-closure valves will offer an increased degree of safety but they have not been in OCS waters long enough to allow a confident

prediction of reliability.

Produced formation water: The waters associated with oil and gas pools which are frequently produced along with the oil and gas are called formation waters. The lower edge or boundary of most oil and gas pools is marked by an oil-water or gas-water contact. In some pools, water is produced with the oil in early stages of production, whereas in others, appreciable water never comes up with the oil.

Most formation waters produced in the Gulf of Mexico are brines, characterized by an abundance of chlorides, mostly as sodium chloride, and have concentrations of dissolved solids several times greater than that of seawater. The total amount of mineral matter commonly found dissolved in oil-field waters range from a few parts per million (ppm) (nearly fresh water) to approximately 300,000 ppm (a heavy brine). One of the highest brine concentrations recorded was 624,798 ppm; or 62.5% from a field in Michigan (Levorsen, 1958).

It is highly unlikely that any of the produced formation water resulting from this sale would ever be piped ashore. Both economic and environmental considerations weigh heavily towards choosing to treat and release the formation water into the ocean at the platform site or reinject it into subsurface formations. In nearly all cases, reinjection is utilized as a secondary recovery technique by pumping the formation water, under pressure, back into the lower reaches of the petroleum-producing zone and thus maintaining good reservoir pressure.

Formation water which is to be discharged into the ocean is first passed through a water-polishing facility that removes all but traces (less than 50 ppm) of entrained oil. However, the water is still void of dissolved oxygen and contains large quantities of dissolved minerals.

d. Workover operations

Since petroleum production involves the handling of flammable fluids under pressure, the safety systems control is of utmost importance to preclude hazardous conditions. Nowhere is this hazard greater than during workover, or remedial operations on a well in order to improve its production rate or to replace faulty downhole equipment. Since workover operations are potentially hazardous, they must be planned carefully, both to keep wells from getting out of control and to prevent or minimize the release of oil to the environment. In response to the hazard of multiple well involvement during workover accidents, the Geological Survey is currently revising OCS Order No. 8; this revision will limit the conditions under which multiple operations may be conducted on an offshore structure. The restrictions will apply to workover operations as well as to drilling and production operations.

To increase production, acid or other fluid and suspended particulate matter may be pumped through the well bore into producing formations. The function of this treatment is to enlarge flow channels leading to the well. The spent acid returns up the well when production is resumed, and is handled as are other fluids from the well.

Sand produced along with the well fluids can cause the well periodically to plug, or "sand-up", and must be removed. Other procedures to increase productivity and oil recovery include the injection of high-pressure steam, water and/or gas into specially prepared injection wells. The water used for this purpose may be taken from the ocean or from formation water. Water too contaminated to be treated, polished and discharged is reinjected into formations, taking suitable precautions to ensure that fresh water aquifers will not be contaminated by oil or salt water. Gas produced from the well may be reinjected for pressure maintenance where feasible or piped to shore for sale.

From the safety standpoint, completion and workover operations must be carefully conducted, and it is their critical nature that, in all likelihood, makes these operations safer than they otherwise might be. Operators of swabbing and wire-line units are well aware of the hazardous nature of their work and are extremely cautious. Despite the potential hazard, safety records during wire-line and swabbing unit work are excellent.

e. Solid waste and sewage disposal

Solid waste accumulating on offshore rigs consists largely of common kitchen waste and shipping containers. Solvents, additives, lubricants and treatment chemicals are shipped in returnable drums.

All solid waste is collected in large containers constructed of

heavy grating. To reduce the bulk before being transferred to shore, wastes are sometimes compacted in mechanical compactors but are generally incinerated in burn baskets suspended from the platform. Ashes are allowed to fall into the water. Non-combustible solids are then loaded into service boats for transfer to shore. Solid wastes, transferred to shore, are emptied into municipal or private sanitary landfills which are subject to the sanitary landfill laws of the state.

Sewage treatment and disposal on offshore rigs and platforms is very similar to the common septic tank, but with the addition of a chlorination system. In this case the septic tank is normally a fiberglass container somewhere on the platform into which all toilet, kitchen and laundry drains discharge. The usual settling and bacterial digestion takes place in this tank and the final effluent is chlorinated. OCS Order No. 8 requires that the effluent shall contain 50 ppm or less of biochemical oxygen demand (BOD), 150 ppm or less of biochemical solids, and shall have a minimum chlorine residual of 1.0 mg/liter after a minimum retention time of fifteen minutes.

4. Transportation of Produced Oil and Gas

a. Pipelines

Construction and burial: Nearly all hydrocarbons produced on the OCS are transported by pipeline (as of July 1974, only 2.7% of OCS crude oil was transported by barge). All natural gas, of course, must be moved by pipeline. A substantial amount of natural gas is necessary to justify economically the construction of a natural gas pipeline. In the early stages of the development of an oil field, small amounts of gas may be vented or flared or reinjected into the petroleum reservoir to maintain good pressure. However, wasteful venting or flaring is prohibited by OCS Order No. 11.

Offshore: Pipelines laid offshore are constructed and emplaced by several different methods, depending mainly on the size, location, intended use and cost. One method, pipepulling, involves the use of barges and tugs to pull sections of welded pipe from an onshore launchway over the preselected right-of-way. These sections may either be dragged along the bottom or suspended by floats. There are at least three limitations to this system. First, an extensive section of shoreline, roughly perpendicular to the shore, must be available for the fabrication and launchway site. (Alternatively, it is possible although more costly to use a launching jetty constructed from the beach out over the water.) Second, the total length of pipeline that can be laid is limited. One company estimates the limit to be 100,000 feet for smaller diameter pipe. Third, the pipeline right-of-way must be essentially a straight line. The pipe

pulling method is not used often for the emplacement of pipelines to OCS locations.

The second method, used in nearly all cases for large-diameter pipelines, involves the welding together of short sections of pipe on a barge while simultaneously moving the barge forward, and allowing the completed expanse of pipeline to sag downward and lay on the seafloor. This operation begins at the offshore location and proceeds toward the intended onshore terminus. The advantage of this system is that the pipeline right-of-way need not be straight, and that any diameter of pipeline can be laid in this way. The main disadvantage is the slow rate at which the laying proceeds; average rates are about 300 to 800 feet per hour.

The third method has become increasingly popular in the last decade for laying smaller-diameter pipelines and involves the use of a lay-barge equipped with a large reel or spool of coiled pipe. With the reel-pipelaying technique, miles of pipe are welded together onshore and the appropriate coatings are applied. Then the pipe is wound onto a large-diameter reel which is mounted on a barge or other floating vessel. The vessel is then transported to the construction site. As the barge is towed along the right-of-way, the pipe is pulled off the reel through straightening equipment and continuous lengths of pipeline are laid on the seafloor. The reel method has several advantages (Johnson, 1971). With no welding and little crane work being done on the barge, the operation is much less susceptible to interruption by bad weather and high seas. A thicker-

walled pipe is used, eliminating the necessity of a concrete coating for negative buoyancy, increasing the pressure rating and adding significant corrosion allowance. This method allows pipelaying to proceed at a much faster rate than other methods; 5000 to 10,000 feet per hour.

The reel method has two principal disadvantages. First, economic considerations limit the diameter of the pipe that can be laid to 12 inches. There are plans, however, to increase this capability to 24 inch pipe. Second, during pipe-handling operations, pipe coatings are subject to occasional damage, necessitating repairs and thus, slowing the rate of pipelaying.

In depths under 200 feet present OCS administrative procedures requires burial of the pipeline. Burial is effected by jetting sediment away from underneath the pipeline and allowing it to sink into the resulting trench. The equipment used in this operation consists of a work barge equipped with high volume/high pressure water pumps and air compressors. From the barge, a multiple membered towline consisting of a strength member, water line and air line extends downward to a U-shaped structure which saddles the pipeline and glides along it on rollers, affixed to the U-shaped jetting device are several nozzles which direct water and air, under high pressure, ahead and below the pipeline. Sediments are blasted out of a narrow trench by the water jets, partially lifted by the air and deflected to the sides by various types of fins. The suspended sediments fall

diffusely along either side of the trench. As the jetting device is pulled forward, the pipeline settles into the trench and is partially buried quite soon by the reworked sediment as it slips and settles back into the depression. Complete burial and restoration of original bottom contours may require additional time. In shallow waters, experience has shown that contour restoration is quite rapid, whereas in deeper waters, more than a year may be required.

Even though a buried line is protected from fluid forces it is not necessarily stable. If it is too light, it will gradually work its way up through the soil and become exposed to the water forces. If it is too heavy, it will gradually sink in the soil and impose additional tensile stress in the line. Design procedures for determining the vertical stability of the line in sands and clays have been developed and are available in the industry.

Difficulties have been experienced in burying pipe in cohesionless sands. In this case the sand will often refill the jetted trench before the pipe can settle into it. Another method, fluidization of the sand, enables successful burial in this type of substrate.

In waters beyond the 200-foot contour, pipelines are not buried. Industry spokesmen maintain that at this time burial in waters substantially deeper than 200 feet is technologically possible but would not be economically feasible. In certain areas of the North Sea, however, pipelines are buried below the seabed out to water depths of 300 feet. Burial to these depths is deemed as a necessary safeguard against damage due to the strong bottom currents in that area.

To prevent corrosion, pipelines are carefully coated with such materials as epoxy compounds or thick asphaltic mastic. If extra weight or mechanical protection is needed, these, in turn, are covered with a layer of dense concrete. The lines are protected from electrolysis by both impressed-current systems and by sacrificial anodes (zinc is commonly used). Corrosion prevention measures are now required by 49 CFR Part 195. Although offshore pipelines are relatively inaccessible as compared to onshore pipelines, they nonetheless can be repaired by divers. Divers have operated safely using helium and oxygen in water depths of 1,000 feet. Diving has been simulated to depths of 2,000 feet in surface chambers, with no ill effects on the divers. With this advanced technology any diver assistance needed to repair pipelines in water depths of 1,000 feet is available with present proven practices.

Although there have been no flowlines laid in water depths of 1,000 feet, the capability now exists to lay pipelines up to 12" in diameter in water of that depth. Should additional pipeline capacity be required, the 12" line could be paralleled to shallower water where a larger diameter line could be laid to handle the production from two or more 12" lines. Although this capability now exists in present technology there has been no need to utilize it.

As in the case of workover operations, the expense of the pipeline installations, coupled with the catastrophic implications for the local marine environment should a major break occur, have combined to dictate a highly conservative design, emplacement and opera-

ting philosophy.

As the pipeline construction approaches and traverses the shoreline, it is buried deeply enough to avoid its being exposed by storm-associated beach erosion. From this point the pipeline construction will be extended toward a storage facility, wharf facility or a major existing pipeline system, in turn leasing to a processing facility, refinery or interstate gas line.

Onshore pipelines: From the beach to their inland terminals, pipelines may cross barrier island and spits, wetlands and uplands. Over elevated terrain, burial consists of the familiar trench-and-back-fill method. Where wetlands and perhaps low spits might be crossed, the push-ditch method is employed. In this technique (McGinnis et al., 1972) a narrow, relatively shallow ditch is excavated by a dragline or clamshell digger. By using a "marsh-buggy" base or by using runners or pads to spread the weight damage to the terrain is minimized. The ditch dimensions may be 4 to 6 feet deep by 8 to 10 feet wide. Pipe sections are joined together at the point of origin of the ditch, the line given temporary buoyance by attached floats, and pushed down the ditch. After being floated into place, the floats are cut loose and the line allowed to sink to the bottom of the ditch. The ditch is then normally backfilled.

Pipeline operation and maintenance: The safe operation and maintenance of a pipeline requires several redundant monitoring systems to ensure the integrity of the line and detect leaks. The primary leak detection system in use (required on all lines built after

March 31, 1970 by 49 CFR Part 195.404 and 195.408) is a set of automatic pressure sensing recorders on both ends of each pipeline system. These recorders are equipped with a built in alarm system which either shuts down the flow automatically or sounds an alarm to alert personnel of an abnormal pressure level. In this way, a leak of substantial rate is detected immediately. This system is insensitive to very small leaks which do not produce a decrease in line pressure.

The second system of leak detection is the routine patrolling of the offshore and wetlands routes by boat or aircraft, and onshore by wheeled vehicle or aircraft. A minimum patrolling frequency of intervals between inspections not exceeding two weeks is required by 49 CFR Part 195.412, but in actual practice is performed more often.

This type of monitoring would result in the detection of all sizes of leaks of course, but would be of little consequence in preventing the loss of a large amount of petroleum in the event a large line was severed. The appeal of a system of regular pipeline patrolling is that it allows detection of small leaks and therefore compliments the pressure-sensing system described above.

The third system for leak detection consists of a series of volume-recording flow meters on either end of a pipeline system. Because nearly all crude oil moves from OCS areas to shore by common carrier lines, it must be metered in the offshore pipeline gathering system and again at the onshore pipeline terminal in order that each producer be properly credited for his share of the common stream. This flow monitoring system has been designed so that the flow sensors

continually indicate net input and output in real time so that attendant personnel are able to discover a decrease in output and alert appropriate stations of the possibility of a leak.

One more safety feature which would be built into all pipelines resulting from this proposal, according to industry spokesmen, is that remotely operated mainline block valves will be provided remotely controlled pipeline facilities in order to allow isolation of segments of the pipelines. [1/] This is an industry standard and therefore "voluntary"; however, most companies operating pipelines subscribe to ANSI and would be expected to follow these recommendations. Table 4 shows the relationship between the diameter of a pipeline and the volume contained per mile of line.

Table 4 Length/Volume Relationship to Linepipe

Size (inches ID	Length Required to Hold 1000 bbl. (miles)	Barrels Per Mile of Line
2.067	45.6	22
4.026	12.0	83
6.026	5.3	189
8.071	3.0	334
10.020	1.9	515
12.090	1.3	750
24.000	0.3	2954

1/ American National Standard Liquid Petroleum Transportation Piping Systems ANSI B34.4-197 434.15, In-press.

5. Terminations of Offshore Oil and Gas Operations

According to industry estimates, with proper placement of wells and sufficient pipeline capacity, a gas reservoir could be profitably drained in as little as ten years. In contrast, some oil reservoirs have been produced for over twenty years in offshore areas. When the reservoir has been depleted to a level where it cannot be profitably produced, operations are terminated. During abandonment, the wells are plugged with cement, the casing severed at least 15 feet below the mud line, the platform removed and all obstructions cleared from the area. All that remains is the pipeline system. Frequently, major trunklines can be used for future oil and gas production from adjacent areas, but smaller spur lines are abandoned in place. Pipeline abandonment consists of first purging the lines of entrained hydrocarbons by water flushing and then severing the ends below the mud line.

APPENDIX E

Summary of Scientific Results

taken from

Baseline Environmental Survey of the MAFLA Lease Areas

CY 1974

BLM Contract No. 08550-CR4-11
State University System of Florida
Institute of Oceanography

State University System of Florida Institute of Oceanography (SUSIO) Consortium

A consortium of investigators from public and private institutions and agencies having special interest and expertise in the Gulf of Mexico Region has been coordinated and managed by the State University System of Florida Institute of Oceanography (SUSIO) in the performing of the Baseline Environmental Survey of the MAFLA Lease Areas.

In addition to the scientists participating in this contract in a formal manner as subcontractors, cooperation and/or liaison was coordinated with appropriate scientific agencies and individuals from state and federal governments.

Participation in the scientific aspects of this program includes the following discipline studies, Principal Investigators, and organizations, hereinafter referred to as the SUSIO Consortium:

DISCIPLINE STUDIES	DESCRIPTIVE TITLE	PRINCIPAL INVESTIGATOR
Water Column	Biota	
Phytoplankton	Phytoplankton Analysis	R. L. Iverson/FSU R. A. Woodmansee/GCRL
Zooplankton	Zooplankton Analysis	F. J. Maturo, Jr. /UF R. A. Woodmansee/GCRL
Microbiological Biomass	Microbial Biomass (Water Sediment)	P. A. LaRock/FSU
Sample Collection and Training	POC/DOC	G. A. Knauer/FSU
Water Column	Chemistry	
Hydrocarbons	Water & Plankton Suspended Particulates	J. A. Calder/FSU R. H. Pierce/U.So.Miss.
	Dissolved Hydrocarbons	W. M. Sackett/TAMU
	Dissolved Hydrocarbons	D. R. Schink/TAMU

Trace Metals	Zooplankton/ Particulate Dissolved	P. R. Betzer/USF D. A. Segar/NOAA/AOML
Nutrients	Micronutrient Analysis	K. A. Fanning/USF
<u>Benthos</u>	<u>Geology</u>	
Sediment Geology		L. J. Doyle/USF T. V. Mayou/USF
	Carbonate Bottom Sediments	H. R. Wanless/UM
<u>Benthos</u>	<u>Biota</u>	
Histopathology/ Archiving	Macroinvertebrates	J. J. Blake/USF
Bottom Photography Remote	Bottom Photography	T. E. Pyle/USF
Benthic Epifauna/ Scientific Divers	Epifauna and Flora	T. S. Hopkins/UWF
Benthic Infauna	Polychaetes Polychaetes, Biomass Foraminifera Micromolluscs	B. A. Vittor/UA H. Kritzler/FSU W. D. Brock/UM D. R. Moore/UM
Benthic Flora	Saragassum	H. J. Humm/USF
<u>Benthos</u>	<u>Chemistry</u>	
Hydrocarbons	Sediment/Algae Sediment/Algae Benthic Fauna	J. S. Lytle/GCRL T. L. Lytle/GCRL P. A. Meyers/U Mich.
Trace Metals	Sediments Benthic Fauna	B. J. Presley/TAMU S. B. Betzer/USF
<u>Management</u>		
	Procurement & Administration Ship Operations, Logistics	R. E. Smith/SUSIO M. O. Rinkel/SUSIO

AOML Atlantic Oceanographic & Meteorological Laboratories/ NOAA (Public/Federal) Miami, Florida.

FSU Florida State University (Public/State)Tallahassee, Florida.

GCRL	Gulf Coast Research Laboratory (Public/State) Ocean Springs, Mississippi.
TAMU	Texas Agricultural & Mechanical University (Public/State)College Station, Texas
UA	University of Alabama, Marine Sciences Program (Public/State) Dauphin Island, Alabama.
UF	University of Florida (Public/State) Gainesville, Florida.
UM	University of Miami (Private) Miami, Florida.
U MICH.	University of Michigan (Public/State) Ann Arbor, Michigan.
U.S.MISS.*	University of Southern Mississippi (Public/State) Hattiesburg, Mississippi.
URI*	University of Rhode Island (Public/State) Kingsport, Rhode, Island.
USF	University of South Florida (Public/State) Tampa, Florida.
UWF	University of West Florida (Public/State) Pensacola, Florida.

* The Principal Investigator transferred from the University of Rhode Island to the University of Southern Mississippi after work on the contract had begun.

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Appendix E

SUMMARY OF SCIENTIFIC RESULTS as prepared by Dr. F. T. Manheim

A. Introduction

This treatment will attempt to provide a descriptive synopsis of the extensive data presented by some 32 principal investigators, management staff and other personnel who have contributed to the first MAFLA survey. It will be evident that few persons could be sufficiently conversant with the great range of subject matter dealt with in this study to provide a truly critical synthesis of the work, even had time permitted such an effort. In attempting to strike a balance between presenting as much cogent data as possible, while limiting the bulk of this summary, difficult choices had to be made and it was possible to utilize only a small portion of the 14-inch plus stack of documents. Many summary tables and some figures have been drawn from the contributions themselves, others have been prepared or augmented from the data. I have not hesitated to draw inferences and conclusion where these appear to be appropriate, while attempting to stay within the scope of this survey.

Owing to the fact that some treatments lend themselves better, or have been prepared in such a way, as to allow more concise summary, the amount and scope of the original work is not necessarily correlative with the material represented here. Nevertheless, I hope that this overview will provide a guide to the nature and extent of the full contributions. These are referred to by the chief investigator's name(s) (without data) and are listed on the preceding pages.

Much of the data provided in the report will be entered into NODC and other computer banks and will be available to future investigators in this form. In addition, however, it would be a great advantage if the entire report were placed on microfiche cards or other convenient reference form so that not only the raw data themselves but the tabulations as prepared by the individual authors (with notes and ancillary commentary), as well as the text and in-depth evaluations, could be made readily and inexpensively available to future investigators.

In preparing this report, I have received invaluable assistance by the SUSIO staff, especially P. Blizzard. Comments by most of the principal investigators during a recent meeting in St. Petersburg, and P. Yevich were helpful to put the work in perspective. Valuable assistance was provided by T. E. Pyle and L. J. Doyle. I am grateful to M. Bach and W. Jorgenson for their efforts with the manuscript and to Ose Manheim for preparing photographs from negatives kindly provided by T. E. Pyle.

B. Environmental Setting

The SUSIO Consortium's baseline survey is directed and largely

restricted to five discrete lease tracts in the MAFLA* shelf areas of the eastern Gulf of Mexico, extending from approximately 89°W, south of Pascagoula, Mississippi, to a tract west of Clearwater, off Tampa Bay, Florida (Fig. 1). Although it is not possible to deal with these tracts as a continuum, they intercept major changes in environmental habitat. Near the Mississippi Delta, silt-clay, turbid bottoms having low benthic productivity occur. Eastward toward peninsular Florida a transition occurs to a carbonate substrate, more transparent waters, and significant benthic productivity. One high relief area, the Middle Ground, on the outer shelf roughly midway between St. Petersburg and Apalachicola, Florida, represents a unique hermatypic coral reef environment whose associated flora and fauna are displaced far north of their usual limits. It is also a major fishing resource for the northwestern Gulf. Drowned algal reefs have been reported at the edge of the continental shelf south of Mobile Bay. Although topographic and lithologic data are sketchy, other lesser patches of relief and living coral occur on the limestone shelf south of 29° N and provide shelter and habitat for significant bottom populations. These have a still poorly understood significance for fish populations, including tropical species not found in the northwestern Gulf of Mexico.

Facing the lease tracts V, IV, and to some extent III, are a series of offshore barrier bars and islands with sandy beaches on their seaward sides, and silt-mud and tidal marshes on their bay sides. Off tracts II and I are beds of seagrasses and algae that form a productive element challenging or exceeding phytoplankton productivity in the region. At the shore zone itself fine quartz sand beaches alternate with mangrove vegetation that serves to protect shorelines from storm erosion, and provides shelter and organic matter for fish, invertebrate marine and other marine organisms and their food chain elements. The west Florida shelf as a whole is one of the least investigated shelf areas around the U. S. continental margin. Nevertheless, it is known to contain many elements of unusual character. One of these is the Tortugas banks, which form perhaps the most prolific shrimping grounds in the Gulf of Mexico. A band of the inner-central shelf is both the site of recurring outbreaks of red tide (blooms of the toxic dinoflagellate, Gymnodinium breve) and a well-developed drowned karst zone. Submarine discharge is known in this area, the best-known of the occurrences being "Mudhole Spring," 10 miles off Sanibel Island, near Charlotte Harbor and Ft. Myers, Florida. The warm (97° F) character of its discharge indicates that the water is issuing from considerable depth, and provides an indication that the frequently cavernous and possibly fault-related hydrologic pathways that characterize the upper 1000 m and sometimes deeper strata in southwest-central Florida extend offshore.

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* Mississippi-Alabama-Florida

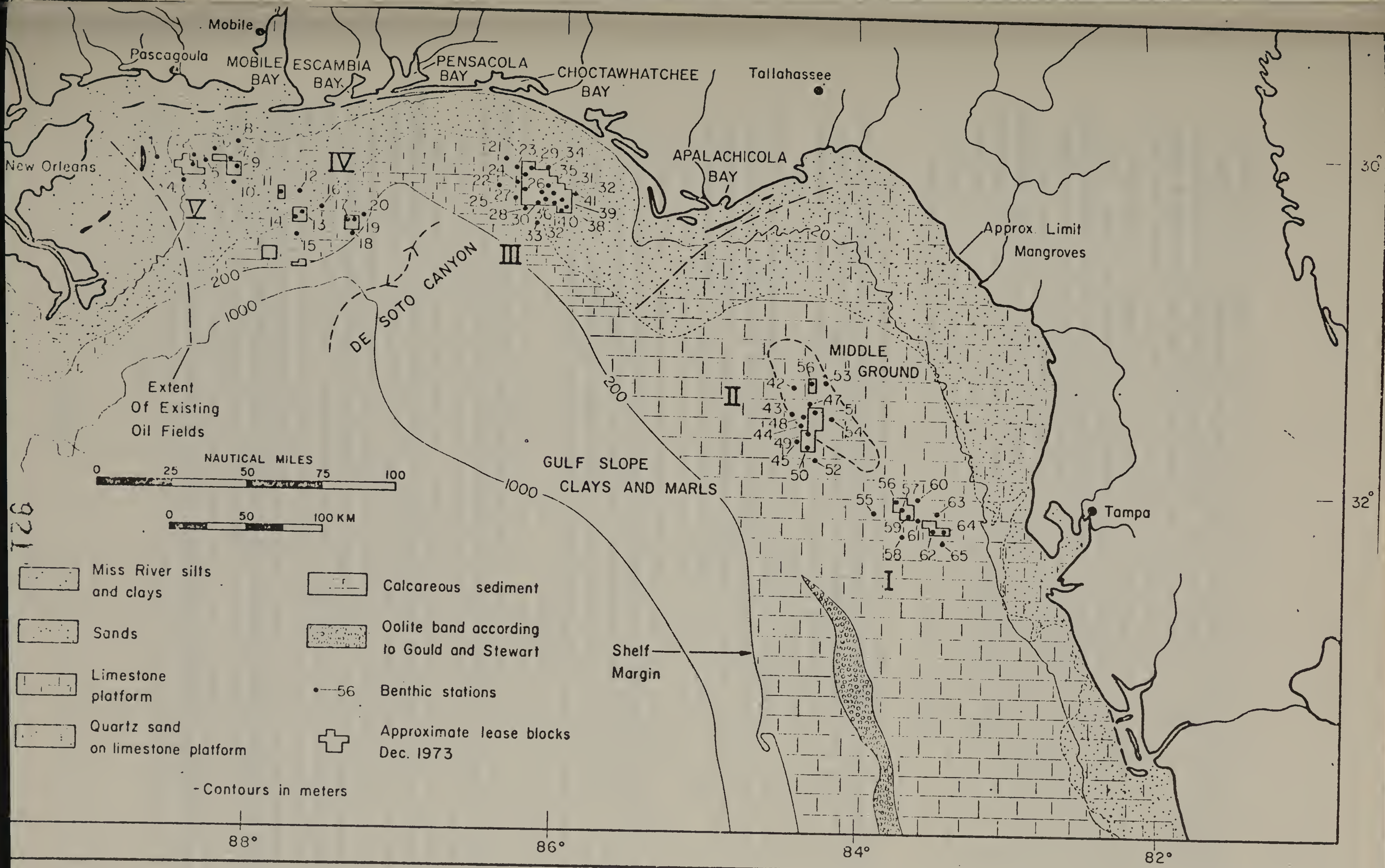


Figure 1. General Location Map of Bottom Stations.
Sources: Ludwick, 1964
Brooks in Jones et al., 1973
Emery and Uchupi, 1972
Gould and Stewart, 1955

One of the keys to the clarity of the Florida shelf waters south of about 29° N, which plays a role in benthic productivity, is the relative paucity of clay minerals in bottom sediments. The carbonate-rich bottoms that extend beyond an inner sand belt to the shelf edge have relatively coarse sediments that are not easily transported long distances under normal conditions. Owing to the generally favorable climate, the attractiveness of the coastline and good fishing, the eastern Gulf shore south of Tarpon Springs has an exceptionally strong tourist industry. Sports fishing follows closely after construction as an economic base of the region, leading commercial fishing by a factor of about 15 to one in terms of dollar value. Although no breakdown is currently available for the west coast of Florida and eastern Gulf States, the total value of the sports fisheries for Florida have recently been estimated by the Florida Coastal Coordinating Council (M. Stursa, personal communication) at about $480 million per year.

Existing pollutants in the offshore land area are an important consideration, for in order to make meaningful use of baseline surveys on the shelves one must quantify contaminant levels, as well as be able to distinguish their origin, if possible. Significant inputs of pollutants of both hydrocarbons, heavy metals and pesticides were noted from a number of estuaries, bays and other areas in the Escarosa study (1973), notably Mobile, Escambia and Choctawhatchee bays, and phosphate wastes, other industrial effluents and sewage waste inputs still occur in Tampa Bay, though at reduced levels. Hydrocarbons in selected barrier bar sediments have been investigated in work in preparation (Palacas, 1975). In the investigated cases, the traceable pollutants (chiefly in sediments) do not extend far offshore. One must not overlook the enormous volume of sediments from the Mississippi River, which contain significant though still relatively sparsely documented pollutants, and are intermittently swept far eastward under special current conditions.

A fact that effects both faunal and floral character in the eastern Gulf of Mexico is the exceptionally irregular nature of current patterns, notably the Loop current, which surges into the Gulf during the late summer-winter period. Warm Caribbean surface waters in some years extend as far northward as the Mississippi Delta before losing coherence. Loop waters have been observed to impinge on the shelf as far landward as the Anclote (Tarpon Springs) estuary. When such loop masses meet flood conditions in the Mississippi River, special entrainment and water movement patterns have caused transport of freshened waters having a salinity as low as 22 °/oo (compared to normal Gulf waters have 35+ °/oo and upward for Loop current incursions) southward along the shelf. Such freshened-water masses may contain river related turbidity and trash and have been observed during 1973 to round the Florida straits and travel northward along the east coast of Florida to Georgia and South Carolina offshore (Wallace, 1972; Atkinson and Wallace, 1975).

Only a few physical oceanographic features will be included in this report since an extensive data search and summary is being presented parallel with this report.

Although substantial literature is available in scattered sources on the area in question, many facets are known only in a sketchy or fragmentary way. The existing data are summarized in two useful compendia. Jones et al. (1973) present an encyclopedic summary of information on the eastern Gulf of Mexico. McNulty et al. (1972) provide an overall survey of the coasts and estuaries along the western margin in Florida, as the first in a proposed 4-volume series.

C. Objective of Study

One of the chief objectives of the study, as mandated by the Bureau of Land Management, was to complete sampling of waters, sediments and organisms on the leased tracts before arrival of drilling rigs in mid-summer of 1974. Scientific targets include the following chief elements.

Water column measurements were to include elements of zoo-and phytoplankton, neuston, basic water properties, nutrients, trace metals, and hydrocarbons in various forms along an extended traverse with stations concentrating on the lease sites.

The chief strategy of the bottom survey was to employ a relatively limited number of master stations (65) with sufficient subsamples (10 at each master station) to obtain a statistically significant evaluation of the existing benthic community. All box cores utilized for this work were to be sieved and sorted for basic organism groups, whereas only a few organism groups, polychaete worms, micromolluscs, and foraminifera were to be determined quantitatively at the species level. Selected invertebrates were to be sectioned, stained and analyzed histopathologically. Such analyses are more sensitive than measure of population changes to impact of pollutants, since influences on specific organs (tumors and necrosis, etc.) may be detected before pollutant levels affecting survival are reached. The remainder of the materials were to be archived as benchmark materials permitting comparison with other seasonal surveys, and in particular, surveys after possible future hydrocarbon discovery and production on the shelf. Where cores were not possible owing to hard substrates, investigation and documenting of surficial flora and fauna and sediment type was to be performed by divers, dredging, and bottom photography, both by diver and by remote camera. All locations for benthic surveys were stipulated to be fixed by state-of-the-art, precision systems (Raydist).

Special attention was to be given to the Middle Ground and Clearwater areas, where bottom flora and fauna are highly developed, and bottom visibility is good.

In addition, description and analysis of basic properties of sediments (carbonate content, grain size, clay mineralogy, petrographic description), carbonate skeletal and organism remains from areas I, II, and III were to be described and categorized by statistical and graphic methods as providing longer-term clues to bottom habitats. All these measurements were to be performed on one box core from the 10 at each master station.

A perhaps unprecedentedly intensive study of chemical properties of sediments, waters and organisms was performed. Cadmium, copper, and lead were analyzed to provide a base for evaluating potential toxic pollutants. Barium, used as a weighting material, (as barium sulfate) in drilling muds, was included to provide a tracer for drilling mud; nickel and vanadium concentrations are high in crude oils and hence serve as inorganic (trace) indicators of petroleum residues where the organic fraction has been partially or wholly dissipated by leaching or microbial attack. Iron and chromium may be included in drilling mud additives and also serve as control elements for evaluating levels of other constituents. These metals were studied in bottom sediments (master stations), selected bottom organisms and waters, suspended matter and zooplankton.

Heavy (extractable) hydrocarbons were analyzed by gas chromatography in waters, sediments, benthic organisms and zooplankton, and particulate matter in the water column. All of these measurements were performed to establish baseline levels of hydrocarbons in the pertinent phases. It is realized that sediment, bottom organisms, zooplankton, and finally water and particulate matter in the water column have successively shorter residence times in the environment in question. However, to the extent that the short range phenomena can be related to typical water mass structures, productivity, physico-chemical interrelations, or influence on more permanent phases, their chemical properties were held to have significance worth evaluating. Light hydrocarbons (C_1 - C_5) were determined on bottom, intermediate and surface waters to attempt to detect natural hydrocarbon seeps or other emanations from the sea floor, or evidence of pre-existing pollutants.

Measurements of ATP (adenosine triphosphate) were performed on the water column and sediments. It serves as a measure of living microbial activity, and protoplasmic biomass (including foraminifera and other micro-fauna) which may have implications for general metabolic activity, including the rate at which hydrocarbons may be degraded by natural processes.

Careful attention was paid to intercalibration and other checks on analytical validity, especially in the case of chemical parameters that require state-of-the-art technique or are otherwise critical, such as hydrocarbons. Baseline values of key parameters are useful only insofar as their accuracy and freedom from excessive error occasioned by

sampling and handling procedures can be assured. The level of analytical and manipulative variability must be determined to separate it from natural variability. Checks were performed both by the chief investigators, and outside laboratories chosen by the Bureau of Land Management.

Finally, it was recognized that single occupations of stations do not, for many parameters (especially faunal and floral) constitute adequate baseline information. Though not included in the current program, it was understood that reoccupation of stations and resurvey of parameters would form an element of future continuation studies.

D. Geological Substrate Characterization

1. Lithology

Major geological parameters are shown in Table 1 (from Doyle et. al.). These indicate the following general features. Areas I and II are dominated by carbonate, the greater part being present in sand and silt-size skeletal debris. Clay size matter ($<.004$ mm) is less than 10%, often below 4%. This paucity of clay-sized materials accounts in part for the clarity of the water, since particulate matter, once stirred by currents, will normally settle out quickly.

These sites include a great variety of carbonate skeletal matter, described in detail by Wanless and Dravies. The dominant carbonate organisms contributing to skeletal debris over these areas, as well as area III are molluscan shells, followed by foraminifera, bryozoa and echinoids, and worm encrustations and remains, with the exception of the high relief areas of the Middle Ground. These areas contain large accumulations of coral-algal debris, derived from breakdown of reef products. Calcareous algae typically encrust ridge prominences. The carbonate studies were not performed in areas IV and V.

A sample of the skeletal description is given in Fig. 2 for station 37, in area III. The diagram shows that in the greater than 2000μ fraction more than 70% of fragments are of molluscan origin, the remaining material being about 15% bryozoans and 10% coralline algae. Benthic foraminifera reach their greatest extent in the 500-1000μ fraction. In general, sizes over 250μ were almost exclusively carbonate.

An interesting petrographic observation relates to finding that weathering and biocorrosion of skeletal particles signifies appreciable reworking and exposure of materials and attack of particles on exposed surfaces. This was marked in the Middle Ground area. In contrast, rippled bottoms off Clearwater were frequently characterized by clear, uncorroded grains.

Table 1. Chief geological parameters of bottom (box core) sediments (from Doyle et al.) Clays are defined as $<$ .004 mm; silt is 0.004 - .63 mm; sand is 0.65 - 2 mm; coarse fraction is $>$ 2 mm. Size data based on sieve and pipette analysis.

Sta.	Depth (m)	Coarse Frac. (%)	Sand (%)	Silt (%)	Clay (%)	CO_2 (%) as $CaCO_3$	Lithologic description
				Area I			
55A	44	1.0	38	55	6.1	86	Coarse calcareous sand, shell hash, coral; calcareous silt, inhomogen, substations.
56A	37	.1	62	31	6.5	83	Calcareous silt and sand with shell fragements
57A	38	.7	69	28	2.3	87	Fine calcareous sand, shell fragments, grass and reddish branchlets mud burrow.
58A	43	-	-	-	-	high	Very coarse carbonate rubble; sponge
59A	35	-	-	-	-	high	Carbonate bedrock; no sample
60A	31	.3	62	34	3.7	82	Calcareous sand and silt; sparse shell grass; black particles
61A	33	.8	62	33	3.8	73	Calcareous sand and mud, grass tubes
62A	34	1.5	92	2.5	3.4	89	Very coarse calcareous sand & rubble, pink coral and black particles

Table 1. (continued.)

Sta.	Depth (m)	Coarse Frac. (%)	Sand (%)	Silt (%)	Clay (%)	CO_2 (%) as $CaCO_3$	Lithologic description
63A	30	1.0	46	45	9.3	75	Calcareous sandy silt; shell & black particles
64A	30	.3	50	45	4.6	84	Well sorted fine calcareous sand & silt; shell & black particles, mud tubes
65A	42	.1	57	40	2.1	80	Fine-medium calcareous sand
				Area II			
42A	37	9.7	67	18.6	4.4	82	Calcareous sand & fine silt, small shells debris-filled burrous
43A	45	-	-	-	-	high	Coarse shell & carbonate rock rubble
44A	53	4.3	92	3.3		82	Very coarse calc. & shell rubble, black material and grass tubes
45A	44	1.4	85	8.1	5.3	73	Calcareous sand with high percent black material
46A	37	1.9	86	10	2.3	52	Fine-medium calcareous sand
47A	36	12	85	2.9		93	Shell hash with worm holes, sponges & seaweed, algae
48A	40	1.7	63	34	2.0	82	Calcareous sand with shell and black particles

Table 1. (continued)

Sta.	Depth (m)	Coarse Frac. (%)	Sand (%)	Silt (%)	Clay (%)	CO_2 (%) as $CaCO_3$	Lithologic description
49 A	42	-	-	-	-	high	Top surface clay; fine to coarse sand of carbonate material with black particles
50A	48	1.4	91	7.3		77.4	Coarse calcareous sand & rubble, grass fragments; layered
51A	27	-	-	-	-	high	
52A	54	3.4	49	40.9	6.2	87	Fine calcareous mud with shell & black particles
53A	37	1.8	62	13.2	1.4	88	Medium-coarse calcareous sand with 2 cm fine carbonate on top with shell hash, worm vurrous
54A	34	-	-	-	-	-	
			Area III				
21A	51	9.1	58	31	1.7	76	Calcareous sand, coarse
22A	82	7.6	74	16	3.1	83	Calcareous sand, v.coarse, shell debris
23A	64	.2	36	59	5.1	63	Sandy, calcareous mud, tubes on surface
24A	64	.2	27	67	5.7	68	Fine carbonate mud, burrowed
25A	80	.3	40	51	9.1	73	Sandy carbonate mud

Table 1. (continued)

Sta.	Depth (m)	Coarse Frac. (%)	Sand (%)	Silt (%)	Clay (%)	CO_2 (%) as $CaCO_3$	Lithologic description
26A	57	2.0	73	18	7.0	56	Medium calcareous sand with appreciable quartz silt
27C	68	.2	34	45	21	67	Sandy carbonate mud with quartz
28A	66	7.1	89	3.2		82	Silt & clay, coarse calcerous sand
29A	46	1.7	80	12	6.1	65	Calcareous sand, fine-medium with some quartz admisture
30A	48	2.4	93	4.1		76	Well-sorted calcarous sand-shell hash with quartz
31A	41	5.9	89	4.5		85	Coarse calcareous sand-shell hash
32C	42	-	-	-	-	-	Coarse calcareous sand-shell hash
33A	69	15	80	5.2		80	Layered coarse calcareous sand-shell hash
34A	35	39	59	1.9		80	Coarse shell hash and calcareous algae
35A	36	3.0	94	2.6		70	Coarse calcareous sand-shell hash with quartz sand-clay admixture of calcareous red algae

Table 1. (continued)

Sta.	Depth (m)	Coarse Frac. (%)	Sand (%)	Silt (%)	Clay (%)	CO_2 (%) as $CaCO_3$	Lithologic description
36A	40	4.3	93	2.5		57	Shell hash in cone-shaped holes, calc. algae
37A	40	9.4	87	3.8		65	Coarse calcareous sand with shell hash
38A	38	6.1	83	5.9	4.7	62	Graded (inverse) calcareous sand, shell fragments, polychaete tubes
39A	36	3.1	93	3.3		24	Coarse calcareous sand with larger fragements
40A	36	14.9	83	1.7		34	Coarse quartz sand with carbonate fragments
41A	31	.4	94	4.5	1.0	14.2	Medium quartz sand with shell hash, some calcareous algae
			Area IV				
11A	35	4.1	96	2		13	Brown medium-coarse sand, lower layers include sand hash
12A	36	17	78	3.6		34	Corase sand and abundant shell frags
13A	35	.5	97	1.9		3.2	Fine-medium, well-sorted sand
14A	35	.9	97	2.1		4.9	" " " " "

Table 1. (continued)

Sta.	Depth (m)	Coarse Frac. (%)	Sand (%)	Silt (%)	Clay (%)	CO_2 (%) as $CaCO_3$	Lithologic description
15A	45	.1	96	3.4		6.9	Medium sand, sparse shell debris
16A	36	.3	97	1.9		3.5	Fine sand, well sorted, sparse shell darker bioturbated (?) zones
17A	66	11	85	3.7		84	V.coarse, calc.sand, some quartz sand
18A	82	8.0	85	7.2		84	V.coarse, quartz* calc, sand, mudfilled burrows; sds, well rounded
19A	82	9.2	72	5.8	3.3	45	V.coarse quartz sand and calc. sand occ. muddy inclusions
20A	85	2.9	91	5.7		83	V.coarse calc.sand, worm tubes on surface only.
			Area V				
1A	13	.2	12	53	35	7.4	Soft clayey silt (quartz), minor shell, burrowed
2A	24	2	14	47	33	18	Soft slayey silt (quartz) with shell, burrowed near top
3A	29	.1	20	51	28	16	Soft brnsh. gray clayey silt, streaked with black material and sand, burrowed

Table 1. (continued.)

Sta.	Depth (m)	Coarse Frac. (%)	Sand (%)	Silt (%)	Clay (%)	CO_2 (%) as $CaCO_3$	Lithologic description
4A	29	.1	12	73	15	16	Clayey shelly silt with black organic matter and sand streaks, burrowed
5A	31	.1	25	58	17	19	Brownish silty clay, black streaks and burrows
6A	29	1.4	61	25	12	19	Brownish silty sand with appreciable clay; burrows and shells
7A	32	.6	31	20.2	9.0	17	Fine silty sand, clayey, shelly surface burrow only
8A	24	.6	89	5.0	5.1	8.0	Fine gray sand, trails & tubes on top
9A	31	2.1	74	6.6	5.6	14	Med-fine gray sand, shelly
10A	35	2.2	43	11	2.7	21	Varicolored sand, shelly, some burrows

*quartz. = quartzose

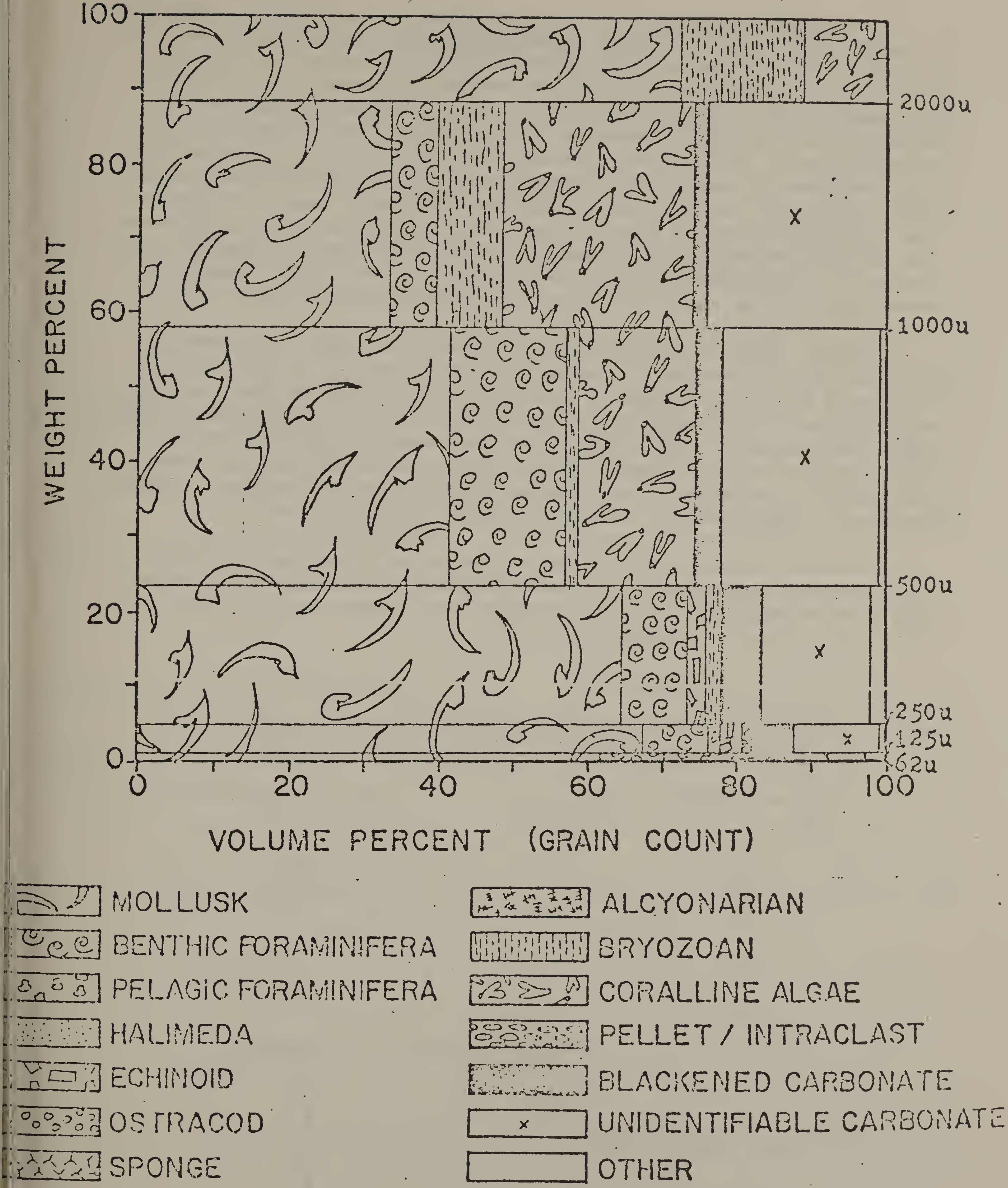


Figure 2. Graphic display of skeletal particle distribution, Area III, Station 37

In area III carbonate is still predominant, but larger quantities of quartz silt and sand occur, especially in the northeastern part of the area. The petrographic studies in some cases also shed light on the degree of dispersal of organism remains by currents after death. For example, Fig. 3 reveals that the coarser echinoid fragments were deposited in a pattern transverse to depth contours in area III. As finer (and more transportable) sizes are reached, the pattern shifts to a longshore or contour-parallel pattern. Such patterns are useful since they place in perspective integrated accumulations of organisms over a longer period of time, in contrast to the variable occurrence that may be present for any sampling of live materials. However, such studies are complicated by the fact that it is not always possible to ascertain the time period over which the accumulations have occurred.

Area IV shows a marked change in lithologic type. The area is divided into a southeastern carbonate facies similar to that of area III, and a northwestern quartz sand facies with limited clay and silt. This area is clearly affected by detrital material from the Mississippi River, and begins to show significant increases in bottom turbidity and suspended matter. Some of the coarser carbonate deposits show evidence of worm borings in the upper portions of the sediment, whereas the quartz sand sediments tend to be bored to greater depth.

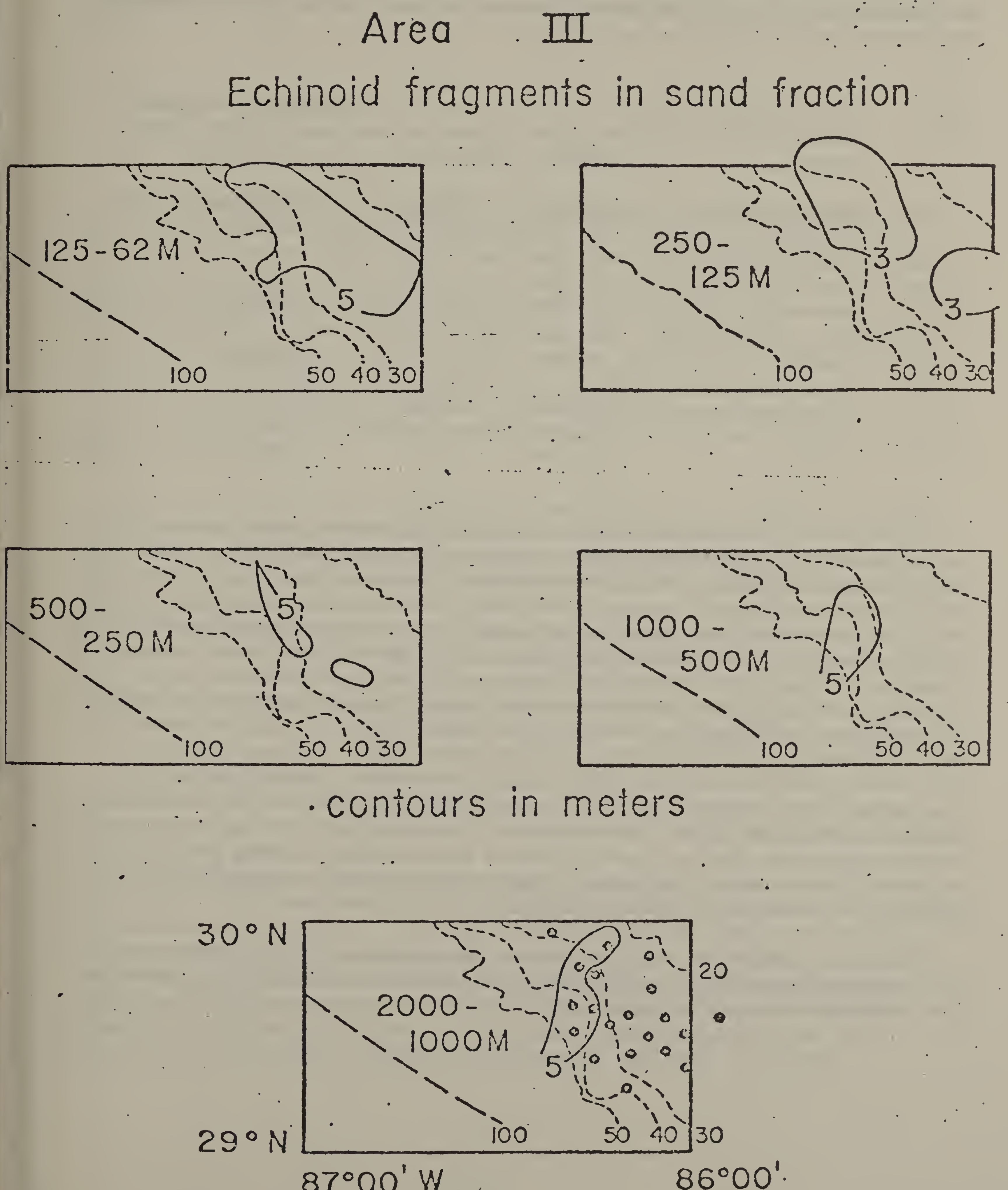
Area V is dominated by silts and sands, with appreciable clays. Black streaks, presumably of organic matter, are common, as is extensive worm burrowing. In spite of this, the organic carbon content is surprisingly low, as given in Table 2.

Table 2. Carbonate and organic carbon content in dry sediments, by area. From Lytle and Lytle, except as noted.

Lease area	C_{org} (%) 1/	$CO_3^{=}$ as $CaCO_3$(%)
I	3.60	86.4
II	2.08	85.9
III	1.42	71.0
IV	0.77	56.4
V	0.58	15.5

1/ On carbonate-free basis.

Figure 3. Distribution of echinoid fragments in sand fractions



Clay minerals are shown in Table 3. These data are in agreement with clay mineral assemblages reported from bottom sediments and suspended matter in the northeastern Gulf of Mexico (Griffin, 1962; Manheim et al., 1972). A montmorillonite-kaolinite suite is being contributed by the Mississippi River. Toward the Apalachicola River kaolinite dominance increases, whereas southward (areas I and II) montmorillonite virtually disappears in favor of kaolinite, with subsidiary concentrations of chlorite and illite.

Table 3. Clay minerals as a per cent of total clay mineral fraction. Range shown excludes a few fringe or aberrant values (from Huang).

	Montmorillonite	Chlorite	Illite	Kaolinite
I	Trace-6	21-33	3-10	56-72
II	Trace-10	13-30	6-16	60-75
III	15-28	10-19	5-12	50-76
IV	50-81	Trace	10-20	16-45
V	66-87	Trace-3	5-7	50-76

One should bear in mind that in the latter areas these minerals do not make up a significant proportion of the bulk sediment, since the silicate clay fraction is very small. However, these data are useful both to identify sources of mineral detritus and establish baseline concentrations for the sediment. For example, discharged drilling muds in quantities of a few to 30 tons per deep hole, should these not be retained at the drill site and dumped elsewhere, will probably have little significance for clay-rich areas such as V, and might be very difficult to detect. In areas I and II, on the other hand, the montmorillonite-rich drilling muds would contrast sharply with local bottoms and might be readily detected. It was earlier feared that drilling mud might be an ecological hazard in the delicate Middle Ground reef sites. Although no documentation on this question is apparently available as yet, on site observations during drilling on area II have as yet not noted significant accumulations of mud or deleterious effects on local organisms.

Strength of sediments (vane-shear measurements) as determined on the box-cored samples by shipboard geologists. These data vary greatly from minimal strength of over 1800 lb/ft^2. The highest rigidities were

observed in shell rubble, which also presented difficulties in penetrating core with the vane. The lowest strengths were reported in area I (a few tens to a few 100's lb/ft^2) with remaining areas fluctuating widely in the hundreds of lb/ft^2. It is evident that poor sorting, expecially box-like frameworks of coarse skeletal debris, mixed with finer sediment, contributes to sediment rigidity, whereas relatively homogeneous, finer silts and carbonate muds are minimally rigid.

E. Benthic Populations

1. Sampling strategy and gross biomass

The prime focus of the benthic studies was to obtain material that would characterize bottom populations in and around the lease tracts in a statistically valid way. Past experience has shown that, in many areas, this is best achieved by combining the information from a larger number of subsamples rather than by sorting and counting an equivalent mass of material from a single large sample. Empirically, studies of N. J. Blake have shown that 10 box cores of the size utilized in this work (21.5 x 30.5 cm) yield the bulk of recoverable species for a variety of benthic invertebrates, in terms of the flattening out of a plot of total species against sample area (see figures 5 and 6, in polychaete section).

Box coring has been taken as the method of choice in soft bottoms, since it provides a reliable sample with good preservation of the critical uppermost layers of the sediment, adequate volume to provide subsamples for the many types of investigations, and adequate area to accomodate larger organism forms. For hard bottoms, a combination of quadrat measurements and annotations, photography and samplings by divers, and Capetown dredging was employed to describe epifauna and flora. The latter were called upon when successive tries with the box corer failed to yield significant sediment, and also to cover certain critical areas such as the Middle Ground where epifauna was luxuriant.

The chief biomass sorting utilized eight box core contents less a small amount of subcore removed. The top 15 cm (approx. 9 l.) were sieved, when penetration was sufficient, through a .5 mm nylon monofilament bolting cloth, and retained materials were placed in bags, narcotized in 15% $MgSO_4$ in sea water to relax organisms, then transferred to drums with 3.8% formaldehyde in sea water buffered with borax to prevent dissolution of carbonate. Through a combination of rough and fine sorting, macro-infauna were separated into five major taxonomic categories - molluscs, arthropods, echinoderms, polychaetes and miscellaneous. After wet weighing (blotted free of excess moisture) materials were packaged in the smallest jar or vial that could contain them and preserved in 60% ethyl alcohol (polychaetes) and 40% isopropyl

TABLE 4

BIOMASS OF MAJOR MACRO-INFAUNA GROUPS IN GRAMS, WET WEIGHT, PRESERVED

8 cores = $0.48m^2$

STATION	MOLLUSCS	ARTHROPODS	ECHINODERMS	POLYCHAETES	MISCELLANEOUS
1	1.9653	.0965	3.5677	4.6947	.2024
2	.3442	1.0137	.3111	3.3048	.1241
3	.1710	.2987	.1882	3.0722	.0760
4	.1525	.2149	46.3035	1.6385	.3366
5	.4605	.0397	.5255	2.0125	1.2518
6	9.9998	.0783	2.3781	8.3006	.4908
7	3.7315	.6008	.5262	3.8692	.3602
8	2.5373	.4549	.2054	7.4364	.9691
9	1.9810	.3461	.9297	7.6078	2.3181
10	1.6170	.2202	.8268	5.1552	1.5847
11	2.9283	10.9692	.1315	3.1475	.6320
12	.2814	.5664	1.1540	4.3523	17.7654
13	.5772	.1032	21.2325	2.7876	.3707
14	.9882	1.0281	.5745	4.2544	14.2854
15	.7510	.0536	.0765	2.0157	.2930

Table 4. Continued

STATION	MOLLUSCS	ARTHROPODS	ECHINODERMS	POLYCHAETES	MISCELLANEOUS
16	13.6503	.4462	.0349	4.0134	2.8461
17	2.0319	.5619	.7317	2.5065	3.2560
18	.4168	.1310	1.1235	1.1822	11.9669
19	19.9838	.6144	.7230	2.1581	10.5763
20	.4835	1.0918	.1997	2.1884	1.8299
21	2.2253	.1828	.2683	1.3510	.9180
22	1.1379	2.7666	.0162	1.5870	3.7093
23	.4988	.1726	.0043	1.8340	.1069
24 1/	.0339	.2093	.0822	2.6660	.1840
25	.3368	.3887	.8241	.8615	.6212
26	1.2486	.2060	.0654	2.5550	.1751
27	.5901	.1992	.8134	.9322	5.6734
28	2.5501	1.8675	.0262	1.1965	.2752
29	.3589	.2138	2.6721	1.5348	.9736
30	.3637	.1269	.0282	1.0099	.1229
31	2.0136	1.0338	.2892	2.3717	3.8885
32 2/	.0383	.1838	.0684	.6119	.0502
33	1.3484	.3949	1.6081	1.1867	.5765
34	4.5422	1.6025	.1071	3.4975	7.0008
35	.8572	.9865	.4855	1.8868	2.5632
36	5.0898	.4951	.6046	2.4617	1.6262
37	2.0821	.8509	- 3/	2.8954	1.4007
38	.9621	.7424	.3418	1.9925	2.1486
39	10.9619	2.8885	.4384	3.3744	17.8035
40	1.4403	.3767	.2516	3.2080	17.0829
41	3.10004	10.2647	- 3/	2.0924	36.0020
42	3.5142	1.2709	2.6699	2.6352	6.2115
43	NO BIOMASS ESTIMATE: DREDGE STATION.				
44	.3133	.8430	16.6984	.9749	16.2542
45	.9242	.1840	1.0792	1.4138	.8497
46	20.1074	.6414	.3557	2.8481	7.6579
47	9.7454	2.6369	6.4664	12.1778	1239.5329
48	.1389	.3285	.2685	1.4612	5.7093
49	NO BIOMASS ESTIMATE: DREDGE STATION.				
50	.9600	2.9809	.1432	1.1700	4.6741
51	NO BIOMASS ESTIMATE: DREDGE STATION.				
52	7.1285	.2381	.2899	.9896	.2144
53	.4901	.4024	2.5772	1.5155	1.2492
54 4/	2.2382	1.3079	.0891	2.0923	4.7541
55	3.0533	2.2769	.0866	.7836	2.0809
56	2.2220	.3897	110.6179	.6740	7.2116
57	.0766	.9619	.5354	1.0118	9.8362
58	NO BIOMASS ESTIMATE: DREDGE STATION.				
59	NO BIOMASS ESTIMATE: DREDGE STATION.				
60	.4709	5.4956	1.0977	1.8469	.8490
61	1.2482	1.1352	.0494	1.0451	3.2575

Table 4. Continued

STATION	MOLLUSCS	ARTHROPODS	ENCHINODERMS	POLYCHAETES	MISCELLANEOUS
62	.8595	.5862	.0100	.9858	1.7114
63	.1711	4.1002	- 3/	.8327	.8587
64	.2498	2.0810	.0190	1.8975	6.6643
65	.1366	1.4729	.0210	1.3574	9.5395

1/ Based on 7 box core replicates; 1 lost
2/ Based on 2 box core replicates (dredge station)
3/ Blank under echinoderms denotes no echinoderms in the sample; not that anything was lost
4/ Based on 4 box core replicates (dredge station)

alcohol for everything else. The gross biomass for the five major groups varied widely:

Molluscs:	.034 -	20.1 g
Arthropods:	.05 -	11.0 g
Echinoderms:	.0 -	110.6 g
Polychaetes:	.61 -	12.2 g
Miscellaneous	.05 -	1239 g

The total penetration of the box cores varied between stations, with the greatest penetration being in Area V and the least being in Areas I and II. It must be recognized that the gross biomass data may be partially affected by penetration and greatly affected by chance recovery of large, heavy specimens (shell), particularly molluscs. Table 4 shows total biomass corresponding to an areal basis.

From the gross biomass, several organism types were selected for detailed identification and counting as indicator groups to shed light on productivity and ecological conditions in the areas in question. The groups selected were polychaetous annelids, foraminifera and micromolluscs. Criteria for selection include ubiquity, variety of life-adaptations, number of species and individuals, the state of knowledge of the organisms in question, as well as the expertise available for this study. These selections proved to be highly successful.

2. Polychaetous annelids

Polychaete worms were found in all areas of the survey, including areas IV and V. Here some 190 species were identified, comprising 41 families, and 10,020 individuals were catalogued. Two families, Scalibregmidae and Sphaerodiriidae, have not been previously reported from the Gulf of Mexico. Since some closely related species and more obscure forms require time-consuming analysis for exact identification, some further new forms may be turned up at a later date.

The major species (defined as making up 5% or more of the sample) number approximately 54 for MAFLA areas I, II and III, and 34 for IV and V. Although some ubiquitous forms (e.g. *Lumbrineris parvipedata* and *Paraprionospia pinnata*) are present, differences in assemblages can be discerned. Stations 1-5 are populated by species typical of fine sediments rich in organic matter, particularly the maldanid species *Asychis carolinae* and *Clymenella torquata*, and the nereid *Ceratonereis tridentata*. In general, this group of stations exhibits low species diversity and abundance.

A highly diverse and abundant assemb lage is present in stations 6-16, typical for sand-silt-shell substrates, whereas a third association occurs in the shell-hash sediments at stations 17-20 (area IV).

The relationship of sampling strategy to community identification

is shown in Figures 5 and 6, depicting a plot of sample area against species total. The figure of 0.48 m^2 approximates the total area of 8 box cores less subsidiary samples. In Figure 5, station 1, samples from only one box core would have yielded only a third of the total species recovered. Yet further box cores would not have added significantly to the total. In Figure 6, an extremely diverse assemblage (station 11) is still increasing at the tenth core, whereas at station 17 the characteristic change in slope toward the asymptote is already marked.

3. Micromollusca

Micromolluscs are small species of molluscs that reach a maximum size of 7 mm, some never reaching 1 mm in maximum length. There generally are no taxonomic divisions separating them from macromolluscs. Micromolluscs in the northeastern Gulf belong to three classes - Bivalvia, Gastropoda and Scaphopoda. Most Bivalvia are filter feeders, although a few forms feed on small animals (e.g., Cuspidariidae) or are deposit feeders. Gastropods are browsers, predators or parasites. Since the abundance of micromollusca is largely determined by their method of feeding and the abundance of the appropriate food, filter feeders and browsers are much more numerous than carnivores and parasites.

In the sampled areas micromolluscs ranked third in abundance among invertebrate microfauna according to the following sequence: foraminifera, micromolluscs, bryozoans, ostracods, echinoid spines and remains, barnacles, microcorals (Guynia), and rare brachiopods. A total of 4,241 bivalves, 3.084 gastropods and 90 scaphopods were identified and counted, and some species remain to be identified fully.

Bottom type and its related physical parameters appeared to be the most important factor in determining abundance and distribution of the species, but in a few cases, depth seemed to be the controlling factor. Signs of heavy predation were everywhere (crabs, shrimp and fish). For this reason, live adult micromolluscs were quite rare, whereas live larval or young postlarval molluscs were fairly common in the fine fractions of the sediment. Thus these animals appear to be an important part of the food chain for larger predatory animals.

4. Foraminifera

Samples were collected from both the upper 3 cm of cores and the 12-15 cm interval, wet sieved through a 63 micron sieve, and retained wet for analysis. In this, identification of living forms (protoplasm content) is possible without the use of staining methods that have been questioned. The number of total and living specimens was determined per ml of sample, and two samplings of 300 were picked, identified and counted: the first for total specimens, the second for a 300 specimen

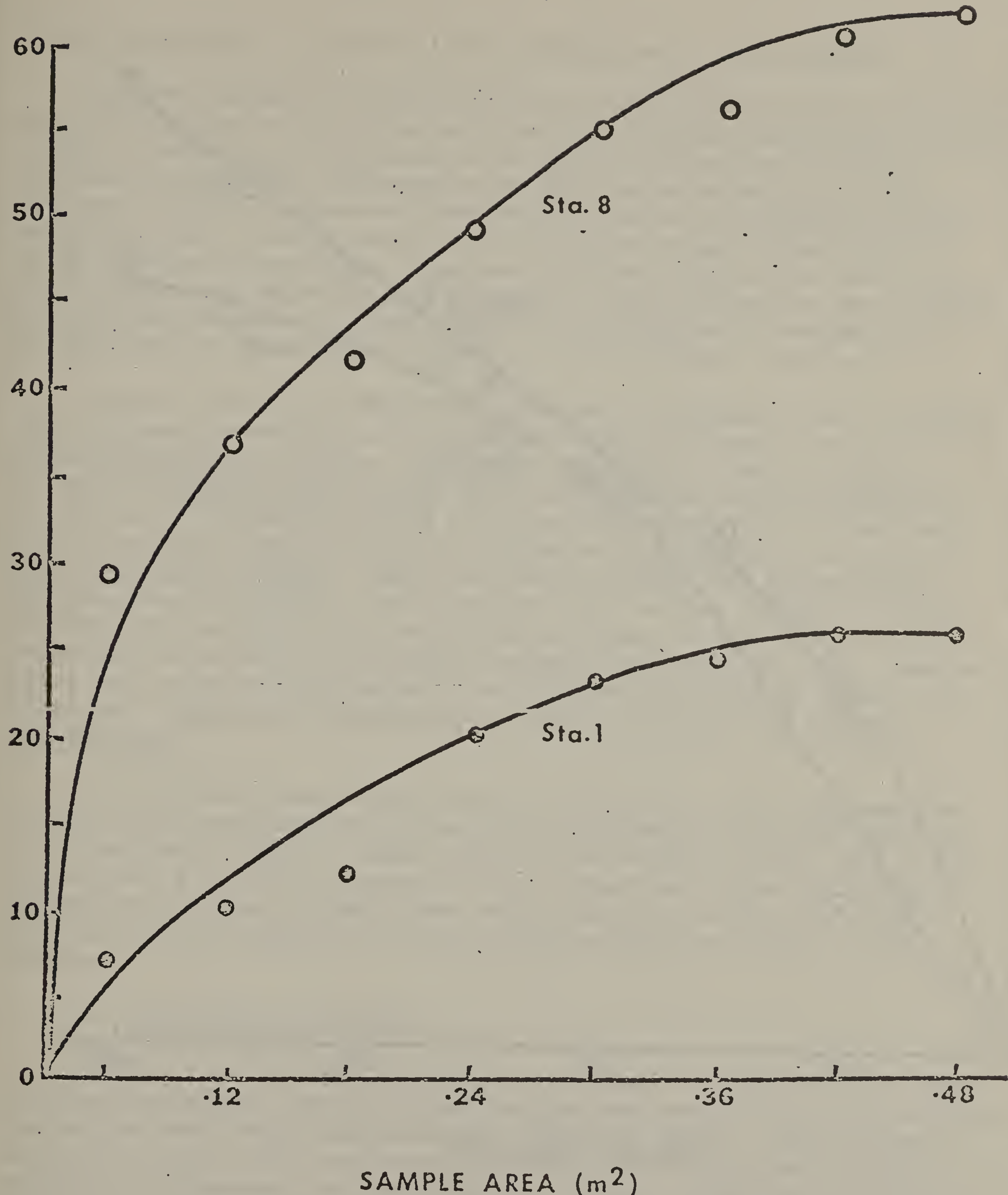


Figure 5. Relationship between sample area and abundance of species at two stations in MAFLA Area V.

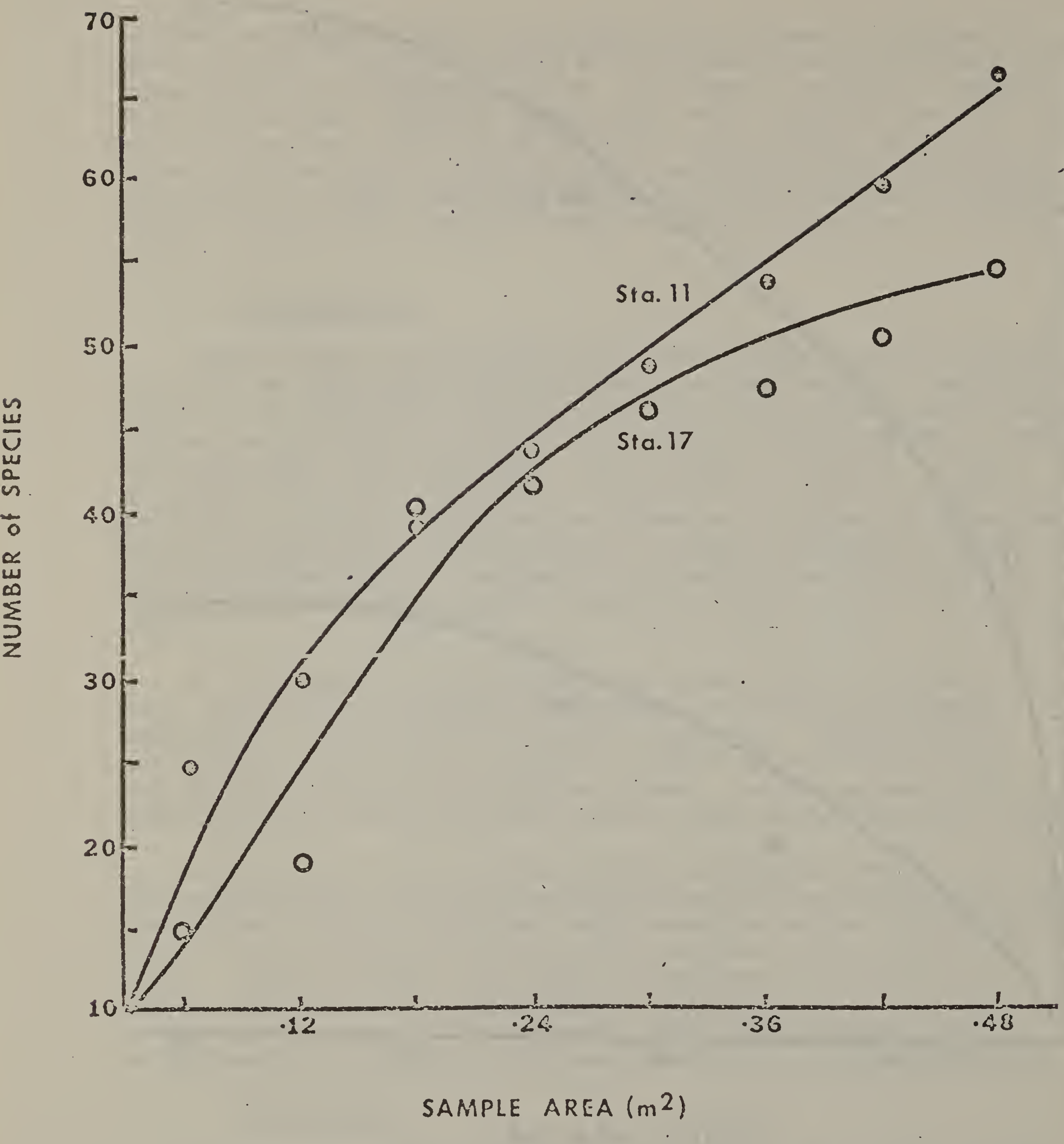


Figure 6. Relationship between sample area and abundance of species at two stations in MAFLA Area IV.

living population. A total of 193 living species was reported.

The percentage of living species is very high in area V (to 66.7%) and decreases to the east and south with the lowest percentage in area I (6%). However, all percentages were higher than expected; many abundant species were represented by high percentages of juvenile specimens. Bock attributes these facts to possible seasonal blooms of foraminifera, and in areas V and IV, high sediment loads with large amounts of nutrients. One may also note that other investigators pointed out heavy grazing pressures, and this may in part account for the preponderance of juveniles. If so, benthonic foraminifera would appear to form key food elements for fish and crustacea.

Overall, fauna are relatively uniform, but areas II and V contain species found abundantly only in their respective areas. Area II contains *Peneroplis carinatus*, *Textularia agglutinans* and *T. conica*, along with *Amphistegina gibbosa* which indicate reef-like conditions, or at least, high energy, hard substrate environments. In contrast, area V contains *Ammonia becarii*, varieties *parkinsoniana* and *tepida*, *Elphidium galvestonense*, and other species capable of withstanding high degrees of stress. These species also contain symbiotic zooxanthellae and dinoflagellate zoochlorellae (green algae) that assist the organisms to survive if turbidity becomes too great for other species. Three species occur in abundance in all five areas and at almost all stations: *Cibicides floridanus*, *Hanzawaia strattoni* and *Rosalina columbiensis*.

A significant observation relates to the fact that specimens at 0-3 and 12-15 cm showed relatively minor differences in their planktonic/benthonic ratios. These ranged from 54:100 to 1:100 (the latter at stations 5 and 65). These data imply that incursions of pelagic fauna (via the Loop current) have been relatively stable in their patterns for the period of time involved between the depths in the sediment.

5. Epifauna and epiflora

According to Hopkins, examination of samples recovered by diving and dredging in the current investigations has revealed new and unusual species in every major epifaunal and epifloral group. The epifaunal groups referred to in this account are decapod crustaceans, sponges, molluscs, echinoderms, and hard and soft corals. Epifloral groups are Chlorophyta, Phaeophyta, and Rhodophyta (green, brown, and red algae). The new species will be dealt with in later journal publications by specialists. Identification of suspected species, except sponges, is proceeding with the assistance of museum repositories at the U. S. National Museum, the Florida Department of Natural Resources Museum, and collections of the University of Miami and appropriate specialists. S. Earle has provided identification for the archived algal specimens.

Quantitative measurements were recorded by use of a portable $5m^2$ frame. Because of species diversity [1] and abundance [2] quantitative measurements were not made on the reefs in area II. Here emphasis was placed on photography and collections with emphasis on coelenterates, sponges, molluscs and algae. Capetown dredging was executed using 10 minute tows. Numbers of species and suspected species are as follows:

Soft corals	19
Hard corals	24
Molluscs	107
Crustaceans	104
Algae	154
Echinoderms	50
Sponges	260

Species diversity as well as abundance varied markedly from station to station within an area, as well as between areas, largely controlled by substrate. In area II even the swinging of the vessel on its anchor chain could direct divers to different subenvironments.

Table 5 provies a summary of biotopes (sediment substrates harboring a given faunal-floral assemblage), indicator organisms, and relative abundance. The numbers following epifaunal-floral groups are coded according to the percentage which has been identified and archived among the total MAFLA species.

The linkages that Hopkins provides between faunal-floral groups and substrate types are particularly valuable because these show coherent patterns for given regions. Thus, in area I, soft carbonate mud areas tended to be depauperate, whereas firm substrates such as hard compacted calcareous sand and shell rubble showed increasing abundance depending on the degree of firmness and occurrence of crevices and other shelters. The highest diversity and abundance for corals, sponges and algae are found in high relief rock ridge areas of area II. Area III biotopes offer wide areas of shell hash and rubble over an apparently hard substrate. Molluscan and crustacean diversity is high, including a large food web. In contrast, fine sandmud bottoms revealed little by dredge. Area IV resembles area II in point of contrasting biotopes over short distances. However, whereas shell rubble produced abundant populations in areas II and III, both species diversity and abundance for all fauna were low in station 12. A distinct

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1/ Diversity is used to represent the number of different species within a genus.

2/ Abundance refers to the total number of species within a given faunal or floral group.

departure in fauna was noted in station 18, containing mud, shell and gravel; this included a deep water ophiuroid not collected elsewhere. Area V was the most depauperate area in the group. Only station 1 revealed indicator species (ophiuroid, Hemipholis and the seam whip, Leptogorgia).

Inter-area comparison reveals that crabs and shrimps were most abundant in areas II and III, well correlated with shell and rubble. Area III had the greatest number of species of molluscs, followed by II and IV, each with 50. Echinoderms were most abundant in area II. Sponges and soft corals, requiring hard substrates, reach greatest species abundance in area II.

In summary, substrate remains the key abiotic factor influencing the structure of benthic communities. Beyond this, Collard and D'Asaro (1973) point out that in depths from about 30 to 200 m the benthic fauna of the Gulf is generally West Indian in composition, where as the deep Gulf fauna has Atlantic affinities. These relationship may partly be related to egg and larval transport via surficial Loop waters to the shelf areas of the Eastern Gulf.

6. Histopathology of benthic invertebrates

As described by Blake, 240 samples of benthic invertebrates were fixed in Dietrich's fixative and embedded in Paraplast, utilizing a 15 hour processing routine on a Technicon tissue processor. The tissues were sectioned at 6 and stained with hematoxylin-ecosin. Two slides each of 2-6 tissue blocks per animal were prepared. These samples are to be archived for future comparison with organism resamplings from the lease tracts. One may note that in the future, samples for histopathological analysis should be collected by dredging or diving, since the specimens obtained in box cores may be too small and too few for meaningful study.

Although the scope of the study did not include analysis of the sectioned samples, some qualitative and preliminary observations may be pertinent. Histopathological study of marine organisms is a relatively new field, hence many of the organic structures observed in the collected organisms are unknown or previously undescribed. This applies, for example, to alcyonarian corals and other epifauna from area II (Middle Ground). From the limited observations made during control of tissue preparation, most organisms and organ development appeared to be normal in character. The chief pathologies noted were reactions to parasites - a normal feature in undisturbed bottoms.

Scallops recovered from areas I-III showed males with spermatozoan development and females ready to spawn. Such developments are significant because the reproductive cycle is one of the organism functions most sensitive to influence of pollutants or other stress conditions.

Table 5

SUMMARY OF BIOTOPES AND COMMUNITY INDICATORS
IN THE MAFLA LEASE TRACT BY AREA

AREA I

BIOTOPE	STATION NO'S	INDICATOR ORGANISMS BY GENERA IN GROUP		RELATIVE SPECIES IN EACH EPIFAUNAL-EPIFLORAL GROUP	COMMENTS
1) Hard Compacted Sand w/Silt	65	a) SPONGES Ircinia Haliclona Spheciospongia b) ECHINODERMS Astropecten Encope	c) HARD CORALS Cladocora d) ALGAE Caulerpa Dictyota Gracilaria e) DECAPOD CRUST. Synalpheus Pylopagurus Raninoides	SPONGES-Moderately Low 17/66 ECHINODERMS-Low 5/36 HARD CORALS-Low 5/22 MOLLUSCS-Very Low 2/86 CRUSTACEANS-Low 20/96 ALGAE-Moderately Low	
2) Shell Rubble, Sand w/Silt	62,64	a) SPONGES As @ #65 b) ECHINODERMS Astropecten Echniaster c) ALGAE As @ #65	d) HARD CORALS Cladocora e) MOLLUSCS Fasciolaria f) DECAPOD CRUST. Synalpheus Pylopagurus Ranilia	SPONGES-Moderately Low 24/66 ECHINODERMS-Low 8/36 HARD CORALS-Low 4/22 MOLLUSCS-Very Low 7/86 CRUSTACEANS-Moderately Low 25/96 ALGAE-Moderately Low	St. 64 Crevices 3-4' deep. Reef fish and epifauna in association with crevices.

Table 5. Continued

BIOTOPE	STATION NO'S	INDICATOR ORGANISMS BY GENERA IN GROUP		RELATIVE SPECIES IN EACH EPIFAUNAL-EPIFLORAL GROUP	COMMENTS
3) Softy & Silty	60, 61	No definitive organisms established		All Groups Low to absent.	
		AREA II			
1) High Profile Rock Ridges	47, 146,147, 151, 247, 251, 451	SPONGES Ircinia Sphaeciospongia Callyspongia ECHINODERMS Ophiothrix Diadema Astrophyton DECAPOD CRUST. Mithrax Macrocoeloma Stenorynchus	HARD CORALS Dichocoenia Scolymia Millefora SOFT CORALS Muricea Plexaura Exunicea MOLLUSCS Chlamys Spondylus Vermiodularia ALGAE Kallymenia Sporodanus Microdictyon	Sponges-Moderate 30/66 Echinoderms-Low Decapod Crustaces-Very low 13/96 Hard Corals-Moderately High 15/22 Soft Corals-Moderate 9/19 Molluscs-Very Low 8/86 Algae	St.146&147 rich in algal species St.142 Soft Coral forest 42 colonies $5M^2$ Sponge species diversity estimate: 15 spp/ $5M^2$. St.47&247 show reduction in algal spp. & increase in hard coral diversity: increase in sponge density & diversity. St.257 &451 Millepora, hard coral, & soft coral are abundant; algal reduced.

Table 5. Continued

BIOTOPE	STATION NO'S	INDICATOR ORGANISMS BY GENERA IN GROUP		RELATIVE SPECIES IN EACH EPIFAUNAL-EPIFLORAL GROUP	COMMENTS
2) Low Profile Rock Patches with Intermittent Sand	42	SPONGES *Ircinia* *Placospongla* *Haliclona* ECHINODERMS *Eucidaris* *Echinaster* *Diadema* DECAPOD CRUST. *Pylopagurus* *Stenorynchus* *Alpheus*	HARD CORALS *Cladocora* *Scolynia* *Millepora* SOFT CORALS *Eunicea* MOLLUSCS *Laevicardium* *Paciea* *Vernicularia* ALGAE *Miciodictyon* *Udoica* *Sarcassum*	Sponges-Moderately Low 20/66 Echinoderms-Moderately Low 14/36 Decapod Crustacea-Very Low 13/96 Hard Corals-Very Low 1/22 Soft Corals-Very Low 1/19 Molluscs-Very Low 9/86 Algae-High	

Table 5. Continued

BIOTOPE	STATION NO'S	INDICATOR ORGANISMS BY GENERA IN GROUP		RELATIVE SPECIES IN EACH EPIFAUNAL-EPIFLORAL GROUP	COMMENTS
3) Coarse Sand	45,46,52, 351	SPONGES Fibulia ECHINODERMS Encope Echinaster Goniaster DECAPOD CRUST. Munida Parthenope Scyllarus	HARD CORALS Oculina SOFT CORALS Muricea MOLLUSCS Chlamys Tellina ALGAE Gigartina	SPONGES-Very low 5/66 ECHINODERMS-Moderate 18/36 DECAPOD CRUSTACEANS-Moderate 42/96 HARD CORALS-Very Low 3/22 SOFT CORALS-Moderately Low 6/19 MOLLUSCS-Moderately Low 15/86 ALGAE-Ver Low	St.46. 3 Meoma, 5 Eucidaris per $5M^2$.
4) Coarse Sand, Broken Rock & Shell	43,44,48,49, 50	SPONGES Ircinia Geodia Tethya ECHINODERMS Eucidaris Echinaster Lytechinus DECAPOD CRUST. Munida Parthenope Pilumnus	HARD CORALS Oculina SOFT CORALS Loptogorgia MOLLUSCS Vernicularia Chlamys Laevocardium ALGAE Caulerpa Microdictyon Dictyota	SPONGES-Moderate 33/66 ECHINODERMS-Moderate 19/36 DECAPOD CRUSTACEANS-Moderate 40/96 HARD CORALS-Very Low 1/22 SOFT CORALS-Very Low 1/22 MOLLUSCS-Moderately Low 20/86 ALGAE-Moderate	

Table 5. Continued.

BIOTOPE	STATION NO'S	INDICATOR ORGANISMS BY GENERA IN GROUP		RELATIVE SPECIES IN EACH EPIFAUNAL-EPIFLORAL GROUP	COMMENTS
5) Hard Packed Sand	246	ECHINODERMS Lytechinus Luidia DECAPOD CRUST. Symethis Calappa Macrocoeloma	ALGAE Caulerpa	SPONGES-Absent ECHINODERMS-Very Low 3/36 DECAPOD CRUSTACEANS-Moderately Low 34/96 HARD CORALS-Very Low 1/22 SOFT CORALS-Absent MOLLUSCS-Very Low 1/86 ALGAE-Low	
		AREA III			
1) Shell Rubble & Coralline Algae	34,35,37, 39 41	SPONGES Placospongia Ircinia Haliclona ECHINODERMS Echinaster Arbacia Eucidaris HARD CORALS Oculina SOFT CORALS Leptogorgia	DECAPOD CRUST. Pylopagurus Stenorhynchus Munida MOLLUSCS Vermicularia Chlamus Aequipecten ALGAE Botryocladia Struvea Rhodymenia	SPONGES-Moderately Low 20/66 ECHINODERMS-Moderate 16/36 HARD CORALS-Very Low 3/22 SOFT CORALS-Low 4/19 MOLLUSCS-Moderate 51/86 DECAPOD CRUSTACEANS-Moderately High 59/96 ALGAE-Low	St.34 Eucicaris $1/5M^2$ Munida forms large biomass St.35,37&39 Rock outcrops 6-12' Rich in commercial fish species. St.41 Astropecten $7/5m^2$.

Table 5. Continued.

BIOTOPE	STATION NO'S	INDICATOR ORGANISMS BY GENERA IN GROUP		RELATIVE SPECIES IN EACH EPIFAUNAL-EPIFLORAL GROUP	COMMENTS
2) Fine Sand-Mud	22	No definite organisms established		All groups virtually absent	St.134 Astropecten $3/5M^2$.
3) Coarse Sand-Occasional Shell	134	SPONGES Cliona ECHINODERMS Astropecten Echinaster Goniaster DECAPOD CRUST. As in 1) above	MOLLUSCS Vermicularia Chlamys Octopus ALGAE As in 1) above	SPONGES-Absent ECHINODERMS-Moderately Low 11/36 DECAPOD CRUST.-Moderately High 59/96 MOLLUSCS-Moderately Low 14/86 ALGAE-Low	St.134 Astropecten $3/5M^2$.
		AREA IV			
1) Shell Rubble	12	SPONGES Haliclona ECHINODERMS Echinaster Goniaster Astropecten	DECAPOD CRUST. Dromida Munida MOLLUSCS Distorsio	All Groups Low to Absent	
2) Fine Sand	13	ECHINODERMS Clypeaster Encope Astropecten	DECAPOD CRUST. Anasimus MOLLUSCS Arqupecten Laevicardium	All Groups Low to Absent	St.13. Clypeaster $6/5M^2$. Encope $2/5M^2$.

Table 5. Continued.

BIOTOPE	STATION NO'S	INDICATOR ORGANISMS BY GENERA IN GROUP		RELATIVE SPECIES IN EACH EPIFAUNAL-EPIFLORAL GROUP	COMMENTS
3) Hard Sand w/occasional Shell	14,16,17	ECHINODERMS Astropecten Luidia Echinaster	MOLLUSCS Distorsio	All Groups Low to absent	St.16 Clypeaster $7/5M^2$. No. Encope Luidia common
		DECAPOD CRUST. Calappa Petrochirus	MULLUSCS Distorsio Murex		
4) Mud, Shell-Gravel	18	ECHINODERMS Stylocidaris Astroporpa annulata Ludia	SPONGES Halichondria	All Groups low to absent	
		AREA V			
1) Very Soft Black Mud	2-6	None established		All groups virtually absent	
2) Mud, Sand, Shell	1	ECHINODERMS Hemipholis SOFT CORALS Leptogorgia	DECAPOD CRUST. Callinectes Penaeus	All groups very low to absent	

Since reproduction is frequently related to or triggered by variations in temperature, further observations may also reveal useful information about timing and reproductive strategy in valuable marine species.

Dredging or other disturbance of marine bottoms may be more disruptive at a time of spawning than at other times.

7. Adenoisine triphosphate (ATP) measurements

The ATP technique provides a measure of total living biomass, since ATP is present in living protoplasm but is quickly dissipated on tissue death. That high-energy organo-phosphate compounds play a prime role in energy transfer in all metabolic processes, was already observed systematically by Harden and Young in 1905. However, analytical studies of these compounds to characterize marine biosystems have been employed only very recently, and the present studies are among the first to be linked with broad surveys of marine parameters.

ATP is extracted from water or sediment samples with sulfuric acid followed by equilibration of extracts with EDTA - TRIS buffer solution. The preparations are frozen prior to laboratory assay. The end determination involves measurement of bioluminescence induced by addition of the ATP extract to a luciferin-luciferase mixture (firefly lantern extract). Detrital and colloidal matter are known to adsorb ATP from solution. Therefore, an internal standard technique is utilized by La Rock in his studies to determine efficiency of extraction, and the final values are obtained by correcting raw data to a 100% extracted basis.

In practice, the bulk of living biomass may frequently lie in bacteria and allied microorganisms with a subsidiary quantity contributed by zooplankton, phytoplankton, micro-infauna, such as foraminifera and the like (see discussion of benthic populations). Unlike virtually all other organisms, bacteria are not only present in aerobic systems (respiration requirement) but can occur in appreciable quantities in anaerobic (anoxic) conditions, owing to the activities of sulfate-reducing and fermenting bacteria. Strictly anoxic conditions in near-surface surficial sediments are likely to be present in the present investigated areas chiefly in the high-organic, high sedimentation rate areas east of the Mississippi Delta (Areas V and in part, IV). Nevertheless, one must recognize that whereas other organisms may be concentrated in the uppermost portions of box cores, or on sediment and rock surfaces, bacteria, and hence ATP, may not only decrease, but actually increase with depth. This effect must be taken into account when relating ATP measurments to surface and near-surface productivity.

La Rock notes that ATP surface values for areas 1, 2 and 3 were equivalent to twice concentrations found elsewhere in the Gulf of Mexico, the Florida Straits, and the Caribbean. The normal range of

ATP concentrations for surface samples in the open ocean range between 80 and 120 mg/1 (.08 - .12 μg/1). Variations with depth for all tracts appeared to be irregular with no consistent change with depth. As may be noted, the fluctuations in concentrations for areas IV and V in the water column were extremely great, and the very marked enrichments here are interpreted as being due to high nutrient and organic content of water, coupled with concentrations of microorganisms on the suspended particulate material. In contrast, the relatively low sediment ATP in areas IV and V reflected the generally improverished benthic fauna.

F. Water Column Studies

1. General approach and water properties

Water column studies were performed on three cruises described in the report by Smith: BLM Cruise #1 (R/V BELLOWS), BLM Cruise #3 (R/V GULF RESEARCHER, and BLM Cruise #5 (R/V TURSIOPS), in May-early June, 1974. Two further cruises #6/7 and #8/9 (R/V GULF RESEARCHER and R/V MISS FREEPORT) were completed between June 17 and June 30.

Some of the water properties such as expendable bathythermograph (XBT) and salinity-termperature-depth determinations (STD), dissolved oxygen measurements were not intended for physical oceanographic studies as such, but rather to link the water column measurements to physical oceanographic compilations and modelling studies being reported simultaneously by the group coordinated by M. Rinkel.

Other collections included: phytoplankton tows, micronutrient and chlorophyll samples, water to ATP, light and heavy hydrocarbons, trace metal, particulate and dissolved organic carbon analysis, and collection of zooplankton for species identification, statistical analysis, hydrocarbon, and trace metal analysis. In addition, surface water "sniffer surveys" were performed for light hydrocarbons on the return cruise of MISS FREEPORT from St. Petersburg to Galveston via Panama City, Florida.

2. Nutrients, chlorophyll, organic carbon, total particulate matter and ATP

Nitrate (NO_3), nitrite (NO_2), silica (SiO_2) and phosphate + arsenate (PO_4 + AsO_4) were determined on 66 samples by Fanning. Thirty-three were sampled by Iverson aboard R/V Bellows (Sites I-III), and 33 by Woodmansee aboard R/V Gulf Researcher (Sites IV and V), each representing 11 stations with samplings at surface (S), middle (M), and bottom (B). Samples were membrane-filtered through .4 μ Nuclepore filters as soon as possible. They were then stored in a clean polyethylene bottle and frozen until analyzed (in triplicate). Replicate samplings showed standard deviations of .01 μg-at/1. Some nitrate samples showed loss in

last replicates, presumed to be due to growth of algae after thawing. Silica and phosphate measurements were performed both by autoanalyzer and manual methods, with agreement usually better than 10% for the generally low values of silica.

The results reveal generally low surface and intermediate values but a pronounced tendency for enrichment in nutrients in the bottommost water samples, especially in the westernmost stations, 10-15, (see location map, Fig. 7). Fanning discusses several possible sources of this effect. Upwelling at the shelf edge is rejected because all nutrients should be approximately equally enriched, yet silica is much more concentrated in the western than in the eastern group, without corresponding increase in nitrate. A possible source is held to be release from interstitial waters of underlying sediments through diffusion or seepage. One may point out, however, that an alternative explanation for the lower nitrate enrichments may be uptake by benthic algae, including zoochlorellae that exist symbiotically on benthic foraminifera, as mentioned by Bock.

Chlorophyll analyses were performed on frozen filters by the standard method of Strickland and Parsons. A persistant increase in depth is revealed by the data in Table 7.

Particulate organic carbon was determined on glass fiber filters by wet combustion. It and dissolved organic carbon was determined according to standard methods described in the instruction manual for the Oceanography International Carbon Analyzer Model 0524. The results (mean values for the 5 lease tracts) are shown in Table 8.

Table 8. Dissolved organic carbon (DOC), particulate organic carbon (POC) and total suspended particulate matter (SPM) for the 5 lease areas. Values in mg/l.

Area	Water Stations	DOC	POC	SPM
I	1,2,3,A1	1.81	.200	.129
II	4,5,6	1.00	.181	.217
III	C-2,7,8,9	1.88	.151	.091
IV	10,11,12	2.19	.147	.125
V	13,14,15	4.00	.215	.368

These data show some puzzling inconsistencies, in that POC values are higher in several cases than total suspended matter. This cannot be due to different sampling dates, for the water samples were presumably drawn simultaneously on cruises of the Tursiops and Gulf Researcher.

TABLE 7.

AREA CHLOROPHYLL SUMMARY

(Grand Mean over all depths, all stations, mg chla m^{-3})

	I	C1	II	C2	III	C3	IV	V	C4
S	0.08	0.11	0.10	0.07	0.05	0.05	0.09	0.19	0.02
M	0.08	0.12	0.17	0.12	0.33	0.23	0.18	0.23	0.22
B	0.35	0.29	0.56	0.62	0.55	0.21	0.43	0.62	0.86
C	0.17	0.18	0.28	0.27	0.31	0.16	0.23	0.35	0.37

CHLOROPHYLL a PER CELL

I	C1	II	C2	III	C3	IV	V	C4
$1.72*10^{-5}$	$1.38*10^{-5}$	$5.40*10^{-5}$	$1.03*10^{-5}$	$2.59*10^{-5}$	$2.36*10^{-5}$	$1.93*10^{-5}$	$2.20*10^{-5}$	$6.40*10^{-6}$

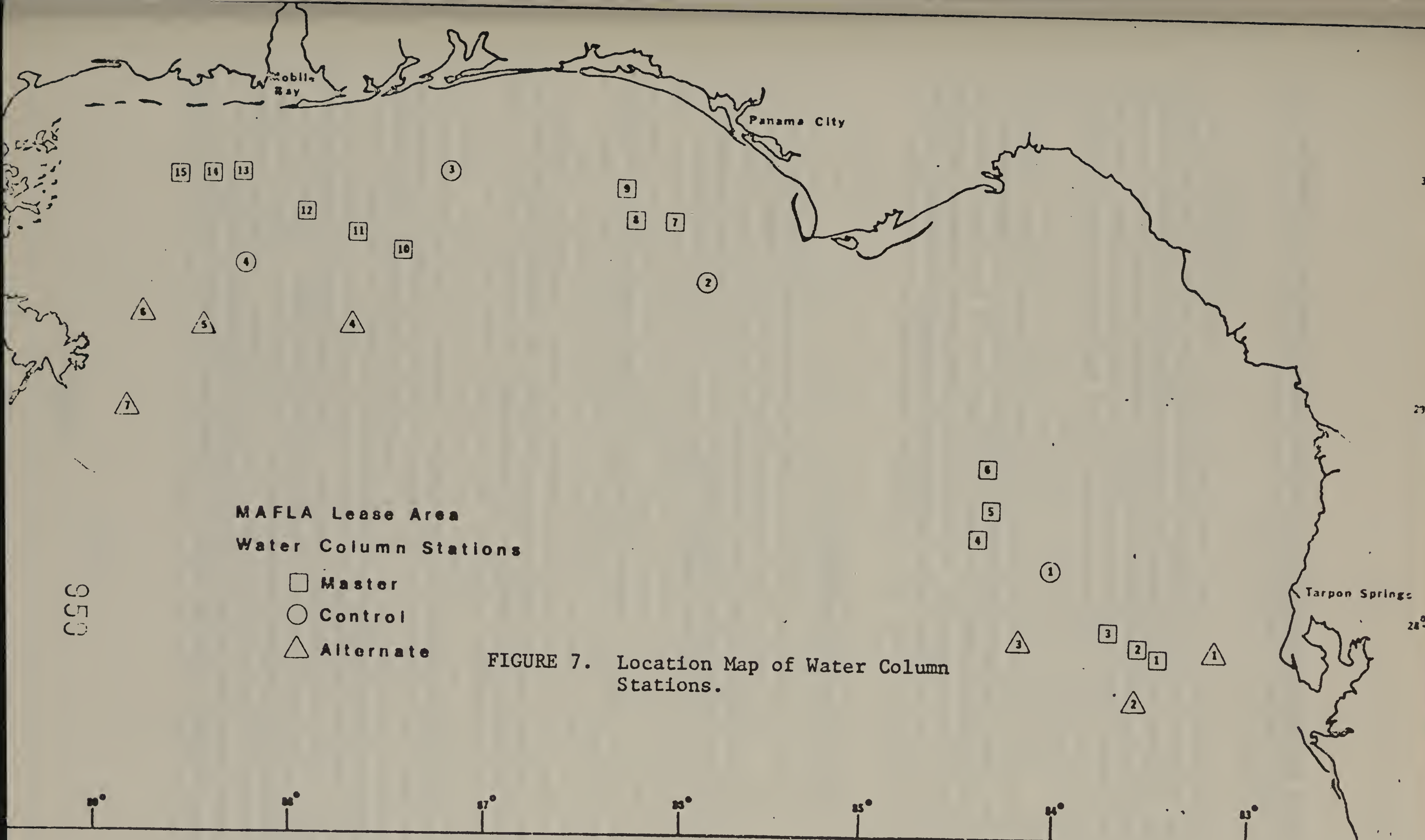

FIGURE 7. Location Map of Water Column Stations.

In neither case were significant systematic differences with depth noted, though Betzer reported a sharp increase in total particulate matter from Station 13 to 1.8 mg/l.

Another surprise is that these particulate determinations did not register greater total particulate content toward the Mississippi Delta in view of known turbidities there, and strikingly confirmed by bottom photography. As was pointed out earlier, at least bottom waters must have in excess of 100 mg/l in several of the benthic stations (1 - 10) in area V. Moreover, ATP measurements by La Rock found up to 20 fold increases here.

In calculating total living carbon from ATP measurements. These data show that living carbon makes up from a third to an appreciable part of particulate organic carbon, or even more in one case. However, these data do not appear to correlate well with the ATP measurements of La Rock, and the original data on which the averages are based. It is therefore suggested that the particulate chemistry be reviewed for computer or other errors.

3. Phytoplankton; sargassum

Net phytoplankton and filtered nannoplankton were tabulated for this study. The highest concentration of cells in net phytoplankton fraction (55,000 per liter) was located at station C-4, where the pennate diatom, *Nitzschia delicatissima* made up 73% of the population. Subsidiary highs were recorded in nearby area V, where the mean of 14,600 cells was also dominated by *Nitzschia delicatissima*. The third ranked station was C-1, where a mean of about 11,000 cells was made up primarily of a centric diatom, *Chaetoceros compressum*, (49%) and *Oscillatoria erythrae* (30%), a blue-green filamentous alga. Total concentrations of nannoplankton showed marked uniformity throughout the MAFLA lease areas, and they were generally lower than net phytoplankton means. Maximum concentration was encountered in area IV (4,900 cells/liter). In brief, diatoms greatly dominated shelf plankton in the MAFLA area, reaching maximum values in the coastal areas.

Another kind of macro phytoplankton, sargassum weed, has properties and a life history that fit it particularly well to serve as a monitor for pollutants in sea water. Eighty-one samples of these algae, as well as benthic algae have been collected and archived for analysis of potential analysis of hydrocarbons or other constituents. These pelagic forms fall into two species: *Sargassum fluitans*, and *Sargassum natans*, which are closely related and tend to overlap. These large forms remain at the surface of the sea by flotation of their air sacs, and harbor an extraordinary community of organisms: bryozoa, mollusca, coelenterates and fishes; Thus, "benthic" organisms are exposed at the sea surface to films of oil at their most concentrated for long periods of time. The selected samples have been frozen in preparation

for analysis. A species list of the algae has been prepared by S. Earle.

4. Zooplankton

The chief zooplankton species encountered in areas V and IV are shown in Table 9. Examination of the extensive tabulated date of Maturo and Woodmansee indicates that in areas I and II, much lower biomasses ranging from 5 to 60 mg/m^3 are typical. Although calanoid copepods remain prominent, other zooplankters, such as gastropod veligers, shrimp bivalve larvae, ostracods, tunicates (oikopleura), globigerina, fish larvae and pteropods are becoming significant. Area III falls in an intermediate position between I and II on the one hand, and IV and V on the other, yielding decreasing bivalve larvae, shrimp and other tunicates. In a very gross way, these relationship correlate also with macrofauna on the respective shelf area, insofar as impinging larvae and eggs are precursors of adult bivalves, ostracods, foraminifera, gastropods and fish.

To grapple with the complex variations in zooplankton within lease tracts, Maturo, Hearne, Ingram, Caldwell and Antonielli have developed an elaborate multivariate statistical program. This is used to study interactions with canonical variables such as hydrocarbon gases, C_3H_8, C_2H_4, CH_4 , sunlight, hour, depth intra-lease tract, and inter-lease tract variables. Whereas hour and hydrocarbon gases did not show correlations, significant relationships were obtained with lease tract, station and, to a lesser extent, depth variables.

To these variables one may wish to add another important one - time and changing water masses.

Mangiordi (Maturo group) has briefly reviewed the literature on the effect of hydrocarbons on marine organisms, and, in particular, zooplankton. The main impacts are direct lethal toxicity, sublethal distruption of activities, effects of oil coatings, tainting and incorporation in food chains and long-range changes of community. The great variability in organism behavior is cited. In the area of sublethal effects, interference with chemoreception is suggested to be an effect of water-soluble components of petroleum products, particularly aromatic compounds. Microbial chemotaxis may also be affected, and affect the rate of degradation of organic substrates in the sea. Although, there are few data on oil's effect on zooplankton, inferences from organisms as diverse as bacteria and fish leave open many possibilities. Oil slicks may reduce light penetration. Oil coatings have obviously adverse implications for marine organisms. Suggestive evidence is cited that oil may be passed through the food chain to produce tainting or accumulate carcinogenic compounds. The discussions of Blumer at Woods Hole are noted

Table 9. Mean zooplankton examples for areas IV and V. Numbers/m^3.

Category	V	IV	Category	V	IV
Total Copepods	9277	6527	Euchaeta	57	71
Paracalanus	3036	1586	Siphonophores	56	126
Acartia	2170	585	Calanus	20	53
Corycaeus	1699	353	Pyrocystis	19	48
Centropages	1320	483	Amphipods	15	29
Appendicularius	742	-	Hydromedusae	15	10
Eucalanus	701	106	Salps	14	252
Cladocera	497	19	Decapod larvae	11	26
Oithona	388	395	Ostracods	11	10
Oncaea	367	496	Ceratium	7	51
Sagitta	341	138	Lucifer (decapod)	4	12
Crab zoea	115	49	Megalops	4	5
Gastropod veligers	112	136	Fish larvae	2	23
Polychaetes	110	45	Foraminifera	1	2
Pelecypod veligers	92	27	Copilia	1	4
Nauplii	72	39	Tintinnids	1	2
Other calanoids	70	81	Egg cases	0	1
Fish eggs	62	57	Echinoderm larvae	0	1
Euterpina	61	20			
			Oikopleura (tunicate)	0	0
			Dry wt. mg/m^3	189	101

with regard to the possibility that crude oil hydrocarbons may follow metabolic or systematic pathways along trails blazed by naturally synthesized hydrocarbons. Finally long-range changes of community owing to reduction of diversity (due to increase in more petroleum-resistant species) is discussed. Changes leading to increased resistance to oil may simultaneously change other factors altering an individual or faunal group's overall probability of survival. These factors are held to play significant roles in determining the ultimate effect of oil in the marine environment.

In discussion Mangiordi points out that chronic sources of hydrocarbon pollution may be more severe than single dosage sources (spills, etc). One may note that in at least one area the recently published "Petroluem in the Marine Environment" (National Academy of Sciences) takes issue with the above critique. It indicates that there is no evidence for food web magnification in the case of petroleum hydrocarbons in the marine environment.

G. Hydrocarbons

1. Water column: sea water, zooplankton, suspended matter and benthic organisms

The composition and components of sea water are recognized as transient properties which may change markedly depending on current movements and systems, input of materials from the shore or the sea floor, the atmosphere - or, in the case of man's entry, from the surface of the sea. As a part of the baseline survey it was regarded as desirable to evaluate the hydrocarbon composition of the water column as reflecting a state of semi-equilibrium or exchange with a "normal," or pre-drilling state environment in the eastern Gulf.

Sea water and zooplankton

Hydrocarbons in water samples over the MAFLA tract showed no consistent trends with depth for either the aliphatic or aromatic fractions of any particular station. Nor were unique hydrocarbon concentrations found in different geographic lease areas; concentrations were extremely low and not far from the limit of analytical detectability. Some typical data, in this case from area III (Destin Dome) are shown in Tables 10 and 11. Similar results were obtained for zooplankton. Whereas aliphatic hydrocarbons tend to have rather similar concentrations at different depths, the aromatics vary widely. The lack of consistent relationships between concentration of aliphatics or aromatices in water and plankton may be either introduced by dietary hydrocarbons or zooplankton synthesis of endogenous hydrocarbon.

Table 10. Hydrocarbon properties for water column stations 7 and 9 (MS refers to master stations), Destin Dome area,

		C17/PRIS		C18/PHY		PRIS/PHY		Odd/Even n-Paraffin		n/Paraffin Phytane		n-Paraffin/ C16	
Surface:	Water	1.22	0.98	1.44	1.34	0.73	1.13	1.14	0.82	53.3	73.5	197	60.4
	Zoopl	0.06	0.10	1.54	2.06	73.9	184	1.43	1.40	49.7	244	28.1	105
Mid:	Water	NA	NA	2.35	1.69	NA	NA	0.97	1.11	150	56.8	NA	NA
	Zoopl	0.18	0.15	3.60	2.58	55.3	99.5	0.94	1.11	1950	355	149	89.4
Bottom:	Water	NA	1.02	NA	2.42	NA	1.17	NA	1.02	NA	39.5	NA	NA
	Zoopl	0.24	0.49	1.50	2.83	9.07	33.9	1.14	1.06	44.5	1020	54.9	248

		n-Paraffin range		Max n-Paraffin		Aromatic range		Max Aromatic	
		MS7	MS9	MS7	MS9	MS7	MS9	MS7	MS9
Surface:	Water	16-31	15-30	23,24	24	21.5-29.6	16.6-31.0	29.6	21.6
	Zoopl	15-25	13-31	21	25	15.9-25.4	14.1-29.7	21.1	27.0
Mid:	Water	18-28	18-28	25	25	21.8-29.6	26.0(only)	29.6	26.0
	Zoopl	13.30	13.30	25,26	25	13.4-29.1	12.3-29.1	14.0	22.6
Bottom:	Water	NA	17-29	NA	25,26	NA	16.5-29.5	NA	29.5
	Zoopl	15-30	12-31	25	26	16.1-29.7	12.0-27.6	27.5	22.6

Table 11. Gravimetric data for hydrocarbons in water and zooplankton, water stations 7 and 9, Destin Dome. Concentrations in original sample.

		Aliphatics		Aromatics	
		MS7	MS9	MS7	MS9
Surface:	Water	2.25	0.38 g/1	3.23	0.70 g/1
	Zoopl	0.10	0.31 mg/g	0.10	3.77 mg/g
Mid:	Water	3.1	3.75	0.13	3.00
	Zoopl	1.63	0.40	4.47	0.75
Bottom:	Water	Lost	4.63	Lost	1.63
	Zoopl	0.34	0.42	0.72	0.57

Water column; light hydrocarbons

Two types of investigations were carried out. The first done in May, in conjunction with retrieval of water samples for other purposes, recovered 111 water samples from surface, middle, and bottom layers of the water column. These samples were extracted and subsequently analyzed in the laboratory at Texas A & M University, Department of Oceanography. Results showed that virtually all samples yielded levels of hydrocarbon that could be expected for equilibrium with the atmosphere.

In June the Texas A & M "sniffer" system, incorporating underway recovery of surface water by means of a hose and pump, was put aboard the MISS FREEPORT for the cruise from St. Petersburg back to Galveston via Panama City (June). On this occasion hydrocarbon levels from two to 20 times equilibrium were obtained in areas III, IV, and V. Areas I and II had near equilibrium values. Additional rechecks were performed for stations A4, A5, and A6, south of area V in late June confirmed the enhanced concentrations.

One explanation of these results might be that the hydrocarbons reported in June represent pollutants carried by the Mississippi River and dispersed in the Gulf. However, in view of the relatively rapid loss of light hydrocarbons to the atmosphere in the upper water column (scrubbed by air in the wave zone), this is not regarded as likely. Sudden sea floor emanations over the large area in question also seem unlikely. More probably, the light hydrocarbons emanate from water

masses in the vicinity of the oil production platforms around the Mississippi Delta (see dashed line, Figure 1). This explanation is supported by anomalously low salinities recorded around Panama City in early June (D. Wallace, personal communication), indicating that a mass of river-freshened water had moved eastward, carrying with it regional waters containing anomalous concentrations of hydrocarbons.

These observations suggest several conclusions.

1) Measurements of hydrocarbons in water at given locations may be less meaningful than identifying hydrocarbons in water masses.

2) No significant amount of hydrocarbon seepage or other emanations were observed over the leased tracts, including the Destin Dome, at a time when there was no communication with oilfield-influences waters to the west.

3) Routine monitoring of low-molecular weight hydrocarbons in the MAFLA Lease areas should be done only if and when oil and natural gas are discovered.

Further data on high molecular weight hydrocarbons in zooplankton and water have been obtained by Myers. He noted that concentration of hydrocarbon in net plankton greater than 202 averaged .31 mg/g for the aliphatic fraction and 1.79 mg/g for the aromatic fraction. Mass spectrometer and hydrogenation data indicate that these are probably polyolefins. The principal aliphatic hydrocarbons was always pristane, which is probably derived from the phytol portion of phytoplankton chlorophyll. Hence the low C_{17}/pristane ratios in zooplankton, averaging $0.13 \pm .10$. Pristane/phytane was high, averaging 167 ± 156. Areas IV and V have much higher pristane/phytane averages than do areas I and II.

No petroleum contamination, including tar balls, was noted on plankton or nets.

High molecular weight hydrocarbons in the water samples ranged from .08 to 7.23 μg/l in the hexane fraction, with an average of 2.1 μg/l. The benzene fraction (aromatic and polyolefinic hydrocarbons) ranged from .08 to 8.4 μg/l. Normalized to total DOC, area II had the highest average aromatic concentrations and area IV the lowest. The chromatographic spectra were among the least complex observed, suggesting that the hydrocarbons may be of recent biosynthetic origin. None of the water samples showed clear evidence of petroleum-derived hydrocarbons.

<u>Particulate hydrocarbons</u>

Approximately 50 l of sea water was passed through .3 glass fiber

filters. Lipids were extracted from the filters with $CHCl_3$/MeOH and the extract analyzed by gas chromatography. Results showed that samples C-1 through 6 had total lipid concentration in the range of .1 to .5 mg total sample (2-10 μg/1). Samples MS-7 and MS-9 (area III) had less than .1 mg/sample. Aliphatics were not detected below .05 mg/sample. Aromatic hydrocarbons were present in concentrations up to .15 mg/sample in MS-9 and .13 mg/sample in MS-7. Petroleum hydrocarbons were not indicated from the chromatographic results. From sites C-3, C-4, 10, 12, 13, and 15 (areas IV and V) similar lipids were obtained. However, here all sites showed .01 mg to .05 mg aliphatic hydrocarbons/sample (.2-1.0 g/1). Aromatic hydrocarbons gave the same 3-peak pattern as before. The unresolved aliphatic envelope from n-C_{18} to n-C_{30} suggests weathered petroleum hydrocarbons stemming from low-level, chronic influx.

Benthic organisms

According to data on benthic organisms Table 12, most organisms studied contained considerably larger amounts of unsaturated hydrocarbons than saturated hydrocarbons, and the same group of the former appeared in essentially all organisms. Biogenic hydrocarbons such as pristane and squalene were important components. No series of homologous n-alkanes resembling Gulf crudes were evident. Thus, a variety of organisms including shellfish, echinoderms and sponges, indicated no evidence of chronic or severe petroleum pollution.

Table 12.

HYDROCARBONS IN BENTHIC MACROFAUNA

Lease Area	Individuals	% (aliphatics/lipids)	%(aromatic/lipids)
I	7	0.04 to 0.66	0.29 to 0.97
II	7	0.05 to 0.38	0.05 to 3.70
III	3	0.15 yo 0.38	0.44 to 2.30
IV	10	0.05 to 0.70	0.27 to 2.33
V	2	0.32 to 0.69	1.02 to 1.34

2. Sediments

65 samples, or one for each master box core station (plus archive samples) were collected for sediment hydrocarbon study. Organic carbon, lipid, and aliphatic and aromatic data (gravimetric) indicated that most samples would be amenable to analysis. There appears to be relatively little aliphatic/aromatic variation in area I, suggesting a uniform source of hydrocarbons in the area. Data indicates that aromatic hydrocarbons are more abundant in peripheral stations than in the center of the area. The isoprenoid parameters of the lipids suggest that in areas I-III organic sources of hydrocarbons such as algae or plankton are more likely than petroleum hydrocarbons. On the other hand, all of area V and a part of area IV (stations 15-20) contain an envelope of aliphatics containing appreciable quantities of C_{14}-C_{20} n-alkanes with a fairly smooth distribution. The alkane distribution and the isoprenoid ratios are those typical of sediments that have been exposed to crude oil. The petroleum-like hydrocarbons have been weathered only slightly. More severe weathering would cause relatively lower C_{14}-C_{20} concentrations and the C_{17}/pristane and phytane ratios would be correspondingly lower. The pristane/phytane ratio average is in agreement with oils produced in the Gulf.

In addition to hydrocarbons, a suite of algal samples were analized. Chromatograms of natural algae show that these aliphatic hydrocarbons have a rather simple structure with prominent C_{15} and C_{17}. Their spectra may be complicated by encrusting animals such as bryozoa. However, one sample (red alga Goniolithon) from station 13 contains a series of normal aliphatics from C_{20} to C_{30} in large quantities and with no odd-even preference. The sample also has a low ratio of resolved peak/unresolved envelope. That has been used to characterize petroleum pollution, and points to hydrocarbon of petroleum origin in this case.

H. Heavy Metals

1. Water Column: zooplankton, suspended matter, and benthic organisms

Water column

A threefold system was used by Segar to analyze trace metals in waters: waters were injected directly into the graphite furnace of an advanced atomic absorption spectrometer; acidified waters were injected, and organic extracts (APDC-MIBK) were injected. Bottles were delivered to the laboratory by hand. They had been filled with water filtered on shipboard through a Nuclepore 0.4 μ filter under carefully controlled conditions. The following observations were made regarding reliability for these difficult (in terms of potential contamination or other systematic error) ultra-low trace metal analyses.

Vanadium showed consistent values on the order of 1.5 ppb, not far from accepted oceanic values. Extractable Ni and Pb show significant variations, but both are in the accepted range for nearshore areas. They show values ranging from 0.25 to 2.5 ppm Ni, and .07 to 1.7 ppm Pb. Extractable Cu and Fe show some major discrepancies from the listed values, or with each other; they are often well above the directly injected samples in concentration. 15% of the extractable analyses gave concentrations higher than total injection. This and similar discrepancies for Cr, Cd, Cu and Fe are attributed, by Segar, to contamination in the laboratory or handling on ship.

Inspection of the data shows immediately that certain values, especially Cu and Fe, appear high and out of context. Nonetheless these are among the lowest general values obtained in the literature for shelf waters, and we may regard them - at the least, as an upper maximu, and confirmation of absence of dissolved metalliferous pollutants.

Suspended matter: Suspended particle mass and trace metal determinations were made on 42 samples from 14 stations. Mean value for total suspended matter was 184 ug/l.

Previous work has shown that organic-rich suspended matter tends to be enriched in trace metals with respect to normal bottom sediments. The present trace metal composition of suspended matter is likewise characterized by such enrichment, particularly with respect to Cd and Ni in areas I and II. If such enrichment is organic in nature, then the values toward the Mississippi River influence (clays) should be lower, This was, in fact, observed for Ni, Cu and Cd for Station 13, where values at 26 m depth dropped to ppm Cd and 17 ppm Cu. These are values that might easily be found in river-bottom sediment. One must express surprise that more samples from area V did not show much higher suspended matter values, in view of the many evidences of high turbidity there. The means are shown in Table 13.

Zooplankton and benthic organisms. As might be expected of highly diverse organism collected among zooplankton, their metal levels were extremely variable. Again, concentrations were higher than expected, and in comparison with Pacific zooplankton. However, one may note that dissolved composition of sea water, as well as suspended matter tends to become relatively more enriched with trace constituents, the more free from particulate matter and the more improverished in nutrients it is.

111 samples of benthic organisms were placed in plastic bags and frozen on board ship. At the shore laboratory samples were thawed,

TABLE 13

SUSPENDED MATTER TRACE METAL SUMMARY +

AREA	NO. OF SAMPLES		S.P.M.* (g/1)	Fe	Pb	Cd	Cu	Cr	Ni	V
I	9	Average	129	.57	200	59	199	160	1486	N.D.
		Range	81-266	.24-.98	76-322	8-243	51-684	-	-	-
II	6	Average	217	.22	145	15	103	N.D.	3609	N.D.
		Range	74-200	.11-.47	44-316	3-25	31-187	-	-	-
III	9	Average	91	1.26	273	29	481	N.D.	N.D.	N.D.
		Range	49-161	.28-4.3	19-975	8-73	133-898	-	-	-
IV	9	Average	125	1.09	189	55	328	144	174	N.D.
		Range	50-334	.10-4.2	107-364	14-100	162-563	64-276	-	-
V	9	Average	368	1.19	109	45	254	120	52	57
		Range	61-1788	.25-4.8	14-209	2-226	17-715	45-191	-	-

+ Values for all elements are in μg/g dry weight except iron which is in percent

* Suspended Particulate Matter in micrograms per Liter of water filtered.

dried and ashed on teflon watch glass in a low temperature asher. The ash was then transferred to a Teflon bomb and disgested four to five hours with hot ultra-pure nitric acid. The solution was analyzed for trace metals utilizing a graphite furnace atomic absorption spectrophotometer

Copper is, as expected highest in crustaceans, which utilize the element in their respiratory pigment, hemocyanin. Echinoderms and molluscs showed copper concentration on the same order as the sediments, whereas sponges and corals had an order of magnitude of lower concentration. Instead of cooper, tunicates use vanadium in their respiratory pigments, and, not surprisingly, showed by far the highest concentration of this element (7 ppm). Nickel is extraordinarily enriched in sponges; their average concentration was more than 100-fold higher than average sediments. It was a matter of regret that lease area V yielded so few macro-organisms, since it would have been expected to show marked differences from the other areas. Though at low levels, lead did increase markedly in crustaceans from this area (0.15 ppm).

Sediments

Samples of each of the 65 master stations were selected for analysis of the 8 trace elements. These data show that trace metals are generally well below the average concentration for nearshore sediments, due principally to the large admixture of metal-poor carbonate. Many of the trace elements correlate with iron, not necessarily as a direct correlation, but merely because increase in iron signifies an increase in detrital clay components known to contain most of the metal concentrations. As pointed out by Presley, a map of trace constituents prepared by Holmes (1973) agrees with the low concentrations found here on much of the west Florida shelf. However, some discrepancies may be noted. Holmes' map predicts between 100 and 150 ppm vanadium in much of area V whereas a mean of only 56 was found in this report. Moreover, Holmes' map indicates more than 300 ppm V, some in an arc of sediments to the south, and between 70 and 100 ppm lead at a depth of about 600 m, south of Mobile Bay. We should recall, however, that the analyses on which the maps are based are semiquantative, and the differences may be more apparent than real. However, this comparison does show that if chemical parameters or threshholds are to have indicative values or environmental significance, the stress placed on analytical accuracy in this survey was not misplaced.

I. Environmental Applications and Conclusions

1. Crude oil-like hydrocarbons have not been identified in sediments, bottom organisms, or organisms or phases in the water column in areas I, II and III. Moreover, the abundance and diversity of organisms, as well as evidence of similar populations living in the same niches on the

shelf in the recent past, suggest that these organisms are living in an essentially pristine and natural ecological state, and show no evidence of stress owing to influx of pollutants. The situation is more complex in area IV. Proximity to the Mississippi Delta and its strong turbidity and periodic freshwater influences, creates a similar kind of stress for the westernmost stations as that encountered more strongly in area V. Some sediments in the area show influences of petroleum-type hydrocarbons in aliphatic components of lipids, whereas others show only the odd-number predominance typical of biologically synthesized hydrocarbons. Organism analyses show similar divergent trends. Heavy metals show background or subbackground levels. Area V sediments revealed universal indications of petroleum hydrocarbons in the sediments. Their weathered nature led the Lytles to infer a Mississippi River origin for them. However, the areas in question are to a large extent poorly productive of epi-and infauna other than stress-tolerant species, and it is probalematical what influence the added hydrocarbons have on the system.

2. Distribution of suspended matter is significant for natural processes of removal of oil. Suspended matter and zooplankton productivity (via fecal pellet formation and sinking processes) are both known to be effective means of collection and sinking of oil pollutants. Hence, off areas V and IV, spills and surficial slicks of oil will be brought down more effectively and rapidly (perhaps by one or more orders of magnitude) than in the clear water areas to the south. This means that, in the absence of human clean-up or recovery, a greater percentage of the oil will remain in surface water of the southern areas to be either moved on by currents or impinged on and absorbed at the coastal zone, except under unusual conditions such as storm-related turbidity.

3. Heavy metals in sediments, waters, organisms or suspended matter have not shown concentrations beyond those expectable for comparable unpolluted materials. In fact, sediments have unusually low background levels for trace constituents over much of the area. In my opinion, heavy metals in petroleum or petroleum-related brine seepages are not a major hazard, owing to their low concentrations in oil and brine. Calculations show that some of the larger historical spills, if distributed over a typical bottom sediment area might have difficulty in building up ambient concentrations beyond background. Moreover, the chief elements in oils, vanadium and nickel, have relatively low toxicity. This does not preclude a buildup of detectable residues of vanadium and nickel in benthic and encrusting and fouling organisms and sediments as a result of chronic low level spills.

The excellent background of analytical information on organisms from a clean environment should invite complementary analyses of similar species from "dirty" environments, if they can be found and vouched for, to establish comparative knowledge of metal influences on a wide spectrum of organisms.

Trace elements may be potentially more significant as pollution from land sources. The investigated sites were not close enough to shore and potential sources of pollutants to detect plumes and ranges of influence of land-derived wastes. Baseline maps of trace element and hydrocarbon constituents should, in the future extend to the shore to delineate land-derived influences from potential offshore pollutants.

4. Over the short range, substrate largely controls bottom fauna. This is true to an extreme degree in the Middle Ground. Over wider areas other factors come into play: temperature, recruitment of eggs and larvae via water movements are examples. The unusual fauna and flora of both the Flower Garden (Bright and Pequegnat, 1974), and the Middle Ground reefs may require a combination of bottom substrate and impingement of Caribbean breeding stock, transported by the Loop Current.

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APPENDIX F

Port Activities for Major Gulf Coast Ports

a. Port of Tampa

(1) This port is located about midway along the west coast of Peninsular Florida. Tampa is a major port for shipping phosphate rock and receiving petroleum products and sulphur. It is also one of the states largest industrial and distribution centers for an area that extends inland over a radius of about 100 miles. This port is about 45 miles from deep water in the Gulf of Mexico and about 70 miles from 120-foot water depth. The port of Tampa has an authorized depth of 43 feet and width of between 500 and 600 feet. The harbor area includes a channel through Tampa Bay to Hillsborough and Old Tampa Bays. Tampa Harbor provides access to the principal marine terminals in the Tampa area, including several which are reached by branch channels connecting with the main bay channel.

(2) Natural water depths in the bay are generally very shallow within about one-half mile from the shores, increasing toward the center to depths ranging from 20 to 30 feet.

(3) Storage facilities include elevators for approximately 350,000 bushels of grain, about 2,000,000 square feet of transit sheds, and about 9,495,000 barrels of storage for crude oil and refined petroleum products. Railroad facilities include approximately 7,000 feet of marginal trackage connecting to the Seaboard Coast Line Railroad. Two interstate highways, I-75 and I-4, and other Federal

and state highways connect Tampa with other parts of Florida and the United States.

b. Port St. Joe

(1) The port of Port St. Joe, Florida, is located on St. Joseph Bay. It is on the northwest coast of Florida, about 115 miles east of Pensacola Harbor and about 35 miles east of Panama City Harbor. Port St. Joe is about 10 miles via deep water from the Gulf of Mexico and is about 40 miles from 120-foot water depth. Port St. Joe has an authorized depth of 35 feet and a width of between 300 and 500 feet.

(2) St. Joseph Bay is a partially landlocked body of water formed by a long, narrow encompassing peninsula connected with the mainland at the southern end of the bay. Natural water depths in St. Joseph Bay are generally between 10 and 20 feet deep within about one-half mile from the shores, increasing toward the center to depths ranging to 34 feet.

(3) The harbor area includes approximately 3,200 feet of berthing facilities and about 151,000 square feet of transit shed. There are no storage facilities for crude petroleum. Railroad facilities include trackage connecting to the Apalachicola Northern Railroad. Two highways, U. S. 98 and State Highway 71, connect Port. St. Joe with other parts of Florida.

c. Port of Panama City

(1) The port of Panama City, Florida, is on the north-

eastern shore of St. Andrew Bay, an arm of the Gulf of Mexico, about 105 miles east of Pensacola and 230 miles northwest of Tampa. This port is about 8 miles via deep water from the Gulf of Mexico and is about 30 miles from 120-foot water depth. Practically a landlocked body of water and parallel to the coast, St. Andrew Bay is about 10 miles long. Natural depths range up to about 60 feet with about 7 square miles having a depth of 30 feet or more. St. Andrew Bay is separated from the Gulf by a barrier sand beach known as Lands End Peninsula. The bay has two outlets to the Gulf, one of which is a natural inlet at the eastern end of Lands End Peninsula and the other an authorized dredged channel 40 feet deep and 300 feet wide through the barrier peninsula about 4 miles west of the natural opening. The dredged cut is stabilized by twin rubblemound jetties and serves as the harbor entrance from the Gulf.

(2) St. Andrew Bay is extended to the east by East Bay, about 20 miles long, and to the northwest by West and North Bays, each about 10 miles long. The city of Panama City is on the northern shore of St. Andrew Bay about three and one-half miles from the Gulf entrance.

(3) The harbor area extends along the waterfront generally between Bay Harbor and St. Andrew. Facilities to accomodate ocean shipping, barge traffic, commercial fishing vessels and recreational craft are available at the port. The harbor area includes approximately 10,000 feet of berthing facilities, about 47,000 square feet of transit shed, and storage facilities for about 1,139,000

barrels of crude oil and petroleum products. Railroad service is provided by the Louisville and Nashville Railroad and the St. Louis-San Francisco Railway. The harbor is also served by the Gulf Intracoastal Waterway and three U. S. highways.

d. Port of Pensacola

(1) Pensacola Harbor is on the northwestern coast of Florida about 59 miles east of Mobile, Alabama, and 103 miles west of Panama City, Florida. The city of Pensacola is located on the western shore of Pensacola Bay, an arm of the Gulf of Mexico about 13 miles long and 3-1/2 miles wide, and is separated from the Gulf by Santa Rosa Island. The main port and terminal facilities are situated along the city waterfront about 8 miles above the mouth of the bay. The Pensacola Naval Air Station occupies a large area on the western shore of the bay near its entrance to the Gulf.

(2) Access to the main docks and terminals in Pensacola Harbor is afforded by a dredged channel from the Gulf to deep water in Pensacola Bay, a natural channel in the bay, and dredges approach channel leading from deep water in the bay to an inner-harbor channel adjacent to the docks and parallel to the pierhead line. The entrance channel from deep water in the Gulf of Mexico into Pensacola Bay, about 12 miles, is maintained to a minimum dimension of 35 by 500 feet under the authorized project for Pensacola Harbor. Pensacola Bay is about 30 miles from 120-foot water depth.

(3) A natural depth of 30 feet or more is available in the bay from the Navy mooring basin to the outer end of the approach

channels leading to the docks. Under the authorized project, the approach channels are maintained to 33 feet deep and 300 feet wide, and the inner-harbor channel is maintained to 33 feet by 500 feet.

(4) Facilities to accomodate ocean shipping, barge traffic, commercial fishing vessels, and recreational craft are available at the port. The harbor area includes approximately 9,500 feet of berthing facilities, about 307,000 square feet of transit shed, and storage facilities for about 495,000 barrels of crude oil and petroleum products. Railroad service is provided by the Louisville and Nashville Railroad and the St. Louis-San Francisco Railway. The harbor is also served by the Gulf Intracoastal Waterway and state and Federal highways.

e. Port of Mobile

(1) Mobile Harbor is located along the eastern limits of the city of Mobile, Alabama, which is about 150 miles east of New Orleans, Louisiana, and about 46 miles west of Pensacola, Florida. The harbor is located near the mouth of the Mobile River in the northwest extremity of Mobile Bay. Entrance into the harbor is gained through a main ship channel which transverses Mobile Bay from the Gulf of Mexico. The entrance into the bay, about 30 miles below Mobile, is about 3 miles wide and about 30 miles long. The bay varies in width from 8 miles at the northern end to 20 miles in its lower portion. Natural depths in the bay average from 8 to 10 feet and vary from shallow mud flats in the northern portion to about 25 feet near its entrance. The east and west shorelines of Mobile Bay are

characterized generally by low slopes with an occasional higher bluff. The northern section of the bay is bounded by an emergent marsh and swamp forest bisected by bayous, open bays, and the outflows of the Mobile, Tensaw, Tombigbee, Black Warrior, Alabama and Coosa Rivers.

(2) Mobile Harbor's primary port facilities are located along the lower five-mile reach of the Mobile River and Chickasaw and Three Mile Creeks, which flow into Mobile River from the west. The city of Mobile, situated on the west side of the Mobile River, encompasses the major portion of the harbor's varied waterfront terminals and deep-water oriented industrial complexes. Other terminals and industries are located in the city of Chickasaw, immediately north of Mobile and in the Theodore Industrial Park area located on the western bay shoreline about 10 miles south of the mouth of the Mobile River. Fastland areas along the city waterfront and on the adjacent islands are developed to near full utilization by harbor facilities and port-related industries. The vast expanses of river deltas, marshes and estuaries extend east and northeast from the Mobile River, preventing expansion of the harbor facilities in these directions. Existing channel dimensions for Mobile Ship Channel are 40 feet deep and 400 feet wide, although the channel width in the Mobile River area varies between 400 and 800 feet. Mobile Harbor is approximately 35 miles from deep water in the Gulf and about 65 miles from 120-foot depth.

(3) Facilities to accomodate ocean shipping, barge traffic, commercial fishing vessels, and recreational craft are

available at the port. The harbor area includes approximately 17,800 feet of berthing facilities, about 500,000 square feet of transit shed, elevators for approximately 2,600,000 bushels of grain, and storage facilities for about 447,000 barrels of crude oil and petroleum products. Railroad service is provided by the St. Louis-San Francisco; Gulf, Mobile & Ohio; Louisville and Nashville; and the Southern Railways. Interstate, Federal and state highways connect Mobile with other parts of Alabama and the United States.

f. Port of Pascagoula

(1) Pascagoula Harbor, Mississippi, located on the banks of the Pascagoula River, is on Mississippi Sound, an arm of the Gulf of Mexico. It is located about 30 miles west of the entrance to Mobile Bay, Alabama, and 100 miles east of New Orleans, Louisiana. Access from the Gulf of Mexico into the harbor areas is afforded by a deep-draft channel through Horn Island Pass and Mississippi Sound, which is about 4 miles from deep water and about 36 miles from 120-foot water depths. The entrance through Horn Island Pass is about 3 miles wide. Natural depths in Mississippi Sound range from about 6 feet at 1 mile offshore to a maximum of about 20 feet.

(2) The principal deep-draft port facilities of Pascagoula Harbor are located in the lower 1-1/2 miles of Pascagoula River and in Bayou Casotte, about 4 miles east of the mouth of the river. Pascagoula River separates the city of Pascagoula from a low-lying marsh area which extends westward for about 2 miles to the West

Pascagoula (Singing) River. Through the use of land fill, areas on both sides of the lower reach of Pascagoula River have become highly developed with harbor facilities and port-related industry. The Bayou Casotte Industrial Area was established by the Jackson County Port Authority from an undeveloped land area and is being rapidly developed by both private industry and local governmental agencies.

(3) Under the authorized project, the channels are maintained to 38 feet deep and 225 to 350 feet wide. Facilities to accomodate ocean shipping, barge traffic, commercial fishing vessels and recreation craft are available at the port. The harbor area includes an approximately 85,000 ton storage facility for anhydrous ammmonia and approximately 575,000 square feet of covered storage. Storage facilities are available for about 1,000,000 barrels of crude oil and 9,000,000 barrels of petroleum products. Railroad service is provided by the Louisville and Nashville Railway. The harbor is also served by the Gulf Intracoastal Waterway and state and Federal highways.

g. <u>Port of New Orleans</u>

(1) The port of New Orleans is located on both banks of the Mississippi Rivers in the southeastern part of the State of Louisiana. The lower limit of the port is approximately 81 miles above Head of Passes. The upper limits on the left and right descending banks are 104 and 115 miles, respectively, above Head of Passes. The distances from Head of Passes to the Gulf of Mexico is 20 miles via Southwest Pass and 13 miles via South Pass. South and

Southwest passes are about 1 mile from deep water and about 1-1/2 miles from 120-foot water depth.

(2) The Mississippi River has a clear and unobstructed channel from New Orleans to Head of Passes where the river divides into three main passes: Southwest Pass, South Pass, and Pass a Loutre, two of which, Southwest and South Pass, are improved under the existing navigation project. The mouth of South Pass is 18.5 miles northeast of the mouth of Southwest Pass. From the foot of Canal Street and via the Southwest Pass, the port of New Orleans is 261 nautical miles west of Mobile, Alabama, and 437 nautical miles east of Galveston, Texas. The frontage for deep water vessels within the port limits includes approximately 57 miles along the riverbanks, 11 miles on the Inner Harbor Navigation (Industrial) Canal, and approximately 78 miles on the Mississippi River-Gulf Outlet. The Inner Harbor Navigation (Industrial) Canal in the city of New Orleans connects the Mississippi River with Lake Pontchartrain, the Mississippi River-Gulf Outlet, and the Gulf Intracoastal Waterway east of New Orleans.

(3) There are about 295 piers, wharves, and docks in the port of New Orleans area. Eighty-three are situated on the left bank, and 55 are on the right bank of the Mississippi River within the parishes of St. Bernard, Orleans (city of New Orleans) and Jefferson. Four are on the Lake Borgne Canal, 47 on the Inner Harbor Navigation (Industrial) Canal, three on the Mississippi River-Gulf Outlet Seaway Canal, seven on Michoud Canal, seven on Bayou Sauvage, 67 on the Harvey Canal, 16 on the Algiers Canal, and six on the Bayou Barataria.

(4) Twenty-three waterfront facilities at the port are equipped to receive and/or ship petroleum products; several of these facilities provide bunkering service for vessels. Large ocean-going vessels are usually bunkered at berth by tank barges. Four companies maintain facilities for public storage, drumming, blending, packaging and distributing of various types of bulk liquids. They operate six wharves along the right bank of the Mississippi River with waterside connection and pipelines extending to steel storage tanks in rear with total storage capacity of about 2,839,000 barrels.

(5) Thirty companies operate warehouses having a total of 3,012,450 square feet of dry storage space and 3,720,000 cubic feet of cooler and freezer space; all but two of the warehouses have railroad connections, and all are easily accessible to arterial highways. Four cotton compresses are operated by four of the warehousing companies. Diversified handling equipment is available and special services are provided. Two waterfront grain elevators with a total capacity of 11,387,000 bushels serve the port and are used primarily for the movement of export grain received by barge and rail. Each elevator is supported by adjoining rail yards and has electrically-driven belt conveyors in overhead galleries extending from elevators to dockside.

(6) Eleven locations, consisting of 29.1 acres, provide open public storage facilities for waterborne commerce moving via the port of New Orleans. These open storage areas are owned and controlled by the Board of Commissioners of the Port of New Orleans and are served

by railroad tracks and improved streets or roadways. Other operators with waterfront facilities at the port of New Orleans have open storage areas to meet their own operational requirements; these areas are not usually available for public use.

(7) The port area of New Orleans is served by the following railroads: Alabama Great Southern Railroad (Southern Railway System); Gulf, Mobile and Ohio Railroad; Illinois Central Railroad; Louisiana Southern Railway (Southern Railway System); Louisville and Nashville Railroad; Missouri-Pacific Railroad, New Orleans & Lower Coast Railroad (Missouri-Pacific Lines); Southern Pacific Transportation Co. (Southern Pacific Lines); and Texas and Pacific Railway (Missouri-Pacific Lines). In addition, three terminal lines, the New Orleans Public Belt Railroad, New Orleans Terminal Co. (Southern Railway System) and the Texas Pacific-Missouri Pacific Lines) also serve the port. Interstate, Federal, and state highways connect New Orleans with other points in Louisiana and the United States.

h. Port of Baton Rouge

(1) The port of Baton Rouge, Louisiana, is on both banks of the Mississippi River within the parishes of East Baton Rouge, West Baton Rouge, Iberville and Ascension. Its limits extend from about mile 168.3 above Head of Passes to about mile 255.2 above Head of Passes and include the Baton Rouge Harbor Barge Channel. The port is about 260 miles from deep water in the Gulf and about 263 miles from 120-foot water depth.

(2) The Mississippi River between Baton Rouge and the Gulf of Mexico flows in a generally southeasterly direction through the southeastern portion of the State of Louisiana. At the Head of Passes 211.1 miles below the Louisiana Highway Commission Bridge at Baton Rouge, the river divides into three main passes: Southwest Pass, South Pass and Pass a Loutre, two of which, Southwest Pass and South Pass, are improved under the existing navigation project. The mouth of Southwest Pass is 141 miles west of Mobile, Alabama, and 349 miles east of Galveston, Texas. The mouth of South Pass is 18.5 miles northeast of the mouth of Southwest Pass.

(3) The port of Baton Rouge is at the southern terminus of the 12-foot channel and at the head of the deep-draft channel of the Mississippi River. The port is also served by a direct connection with the Gulf Intracoastal Waterway via the Port Allen Lock and the Gulf Intracoastal Waterway Alternate Route which extends from Morgan City to Port Allen. The existing project dimensions above New Orleans are 40 feet deep (mean low water) by 500 feet wide between a line one-tenth mile below Louisiana Highway Commission Bridge at Baton Rouge 128.6 miles to upper port limits of New Orleans.

(4) Through the port of New Orleans, a distance of 17.2 miles, a 40-foot deep (mean low water) by 500-foot wide channel is within a channel 35 feet deep (mean low water), by 1,500 feet wide, and is measured from a line generally 100 feet from the face of the left bank wharves. From lower limits of port of New Orleans 86.7 miles to Head of Passes, the channel is 40 feet deep (mean low gulf)

by 1,000 feet wide.

(5) There are about 52 piers, wharves, and docks in the port of Baton Rouge area. Thirty-two of these waterfront facilities are on the left bank, 17 are on the right bank of the Mississippi River extending from about mile 169.3 to mile 234.3 above Head of Passes, and three are on the Baton Rouge Harbor (Devil's Swamp) Barge Channel.

(6) Four companies operate warehouses in the port area with a total capacity of 629,000 square feet of dry storage space. These warehouses are used for storing general merchandise, have railroad connections,and are easily accessible to arterial highways. The Greater Baton Rouge Port Commission has open areas which are available for storage of waterborne cargo not requiring protection from the weather. These areas are at their Baton Rouge Harbor Barge Terminal and Port Allen Docks Nos. 1 and 2. Each of the areas is served by railroad tracks and improved roadways. Other operators with waterfront facilities at the port of Baton Rouge have open storage areas to meet their own operational requirements; these areas are not usually available for public use.

(7) Cargill, Inc., operates a waterside grain elevator at Port Allen in rear of the Greater Baton Rouge Port Commission Grain Wharf. The elevator, owned by the Greater Baton Rouge Port Commission, consists of 32 concrete storage silos and 12 circular steel storage bins with a total capacity of 7,500,000 bushels. It is equipped to receive grain by barge, rail and truck and to ship grain by vessel and

truck. An overhead grain gallery, equipped with belt conveyors and catwalk, extends from the elevator to the 330-foot offshore wharf. This wharf has a water depth of 40 feet at average low water plane alongside its face and inner side.

(8) General cargo is handled to and from vessels by ships' tackle or by shore-based, hoisting facilities with lifting capacities ranging up to 150 tons. The Greater Baton Rouge Port Commission owns and operates a 30 ton traveling, full-portal, gantry crane at the Commission's Port Allen Dock No. 1. Thirteen waterfront facilities, predominantly offshore, wharf-type structures, are equipped to receive and/or ship crude oil and petroleum products. There are about 890 storage tanks capable of storing approximately 23,269,000 barrels of crude oil and petroleum products.

(9) The port area of Baton Rouge is served by the Illinois Central Railroad; Louisiana & Arkansas Railway (Kansas City Southern Lines): and the Texas and Pacific Railway (Missouri-Pacific Lines). Interstate, Federal, and state highways connect Baton Rouge with other points in Louisiana and the United States.

i. <u>Port of Lake Charles</u>.

(1) The port of Lake Charles is in the southeastern part of the State of Louisiana, about 130 nautical miles east of Galveston, Texas, and by way of the Southwest Pass of the Mississippi River, is 444 nautical miles west of New Orleans, Louisiana. The city of Lake Charles is on the east side of Lake Charles about 58 miles from the Gulf of Mexico by way of the Calcasieu River and Pass,

the deepwater entrance to the port, and about 138 miles from 120-foot water depth.

(2) The port of Lake Charles, embracing an area of 203 square miles, is located entirely within Calcasieu Parish and includes the cities of Lake Charles and West Lake. The limits of the waterfront at the port include both sides of the Calcasieu River northward from the Calcasieu-Cameron Parish line to the public wharves opposite Clooney Island, a distance of approximately 15 miles, and above the public wharves for a distance of 11.5 miles. The Calcasieu River flows in a southerly direction for a distance of 215 miles to enter the Gulf of Mexico. About 25 miles from the Gulf, it empties into Calcasieu Lake, which is about 18 miles long. Calcasieu Pass is the connection between the lake and the Gulf and is about 7 miles long.

(3) The existing project provides for a 42-foot by 800-foot approach channel with a 40-foot by 400-foot channel to the wharves of the port of Lake Charles at mile 34. Other widths vary from 250 to 350 feet and depths from 35 feet.

(4) The port's waterfront facilities are along both sides of the Calcasieu River; on the west side of Lake Charles; on Old River opposite the north end of Coon Island; along the north and east sides of the channel (The Loop) around Clooney Island; and on the north sides of Contraband Bayou and the Industrial Canal. There are 60 piers, wharves, and docks in the vicinity of Lake Charles of which 47 of these facilities are on both sides of the Calcasieu River, on the north side of Contraband Bayou and the Industrial Canal,

west side of Lake Charles, and on Rose Bluff Cutoff. Four are on the Old River opposite the north end of Coon Island, seven are on the channel (The Loop) around Clooney Island, and two are on Bayou D'Inde. The harbor area includes about 528,000 square feet of transit sheds, about 28,800 feet of usable berthing space, storage facilities for about 90,000 bushels of grain, and about 13,200,000 barrels of storage for crude oil and refined petroleum products. The port area is served by the Kansas City Southern Railway, the Mississouri-Pacific Railroad, and the Southern Pacific Company. Interstate Highway 10, U. S. Highway 90 and state highways connect Lake Charles with other parts of Louisiana and the United States.

(5) The Gulf Intracoastal Waterway, which extend from Apalachee Bay, Florida, to Brownsville, Texas, crosses the Calcasieu River at mile 22.6, about 11 miles below the city of Lake Charles. The Waterway section to the east provides a connection with the Mississippi River System at New Orleans, and westward from the Calcasieu River to the Sabine-Neches Waterway.

j. Port of Port Arthur

(1) The port of Port Arthur is on the westerly side of Sabine Lake at the junction of Taylors Bayou and the upper end of Port Arthur Canal. The port is about 17 nautical miles above the Sabine Pass entrance from the Gulf of Mexico, 81 miles from 120-foot depth, 82 nautical miles east of Galveston, Texas, and by way of the Southwest Pass, Mississippi River, 430 nautical miles west of New Orleans, Louisiana. The towns of Sabine and Sabine Pass are on

the southwest side of the Pass, about 5.0 and 6.5 nautical miles, respectively, above the Gulf entrance.

(2) The Sabine-Neches Waterway, of which Port Arthur is a part, affords deepwater navigation to the ports of Port Arthur, Beaumont, and Orange, Texas. This waterway extends from deep water in the Gulf of Mexico northward through a jettied entrance channel, the Sabine Pass, and Port Arthur Canal to Port Arthur; the waterway then extends through the Sabine-Neches Canal to the mouths of the Neches and Sabine Rivers, then up the Neches River to the port of Beaumont, and up the Sabine River to the port of Orange. The port of Port Arthur has an authorized depth of 42 feet and a width of 800 feet through the outer bar channel and a depth of 40 feet and a width of between 200 and 665 feet.

(3) Sabine Pass connects Sabine Lake with the Gulf of Mexico. The Port Arthur and Sabine-Neches Canals are dredges channels separated by a narrow strip of land from the western shore of Sabine Lake. The Sabine Pass, Lake, and River together form part of the boundary between the States of Texas and Louisiana.

(4) The waterfront facilities at Port Arthur are along the sides of the Port Arthur East and West Turning Basins; Slips Nos. 1, 2, and 3; the Taylors Bayou Turning Basin; the Sabine-Neches Canal; and along the southwest side of the Sabine Pass. The principal waterborne commodities handled at the port are crude petroleum, petroleum products, and chemicals.

(5) Storage facilities include elevators for approximately 3,350,000 bushels of grain and soybean meal, about 81,300 square feet of transit shed, and about 25, 923,000 barrels of storage for crude oil and refined petroleum products. Railroad facilities include about 2 miles of marginal trackage connecting to the Kansas City Southern Railway. Three Federal highways and state highways connect Port Arthur with other parts of Texas and the United States.

k. Port of Orange

(1) The port of Orange, Texas, is on the west bank of the Sabine River, a part of the boundary between the States of Texas and Louisiana. The Sabine River and the Adams and Cow Bayous are part of the Sabine-Neches Waterway. The city of Orange, at the upper limits of the Sabine River Channel, is about 40 miles from the Gulf of Mexico, 104 miles from 120-foot depth, 105 nautical miles east of Galveston, Texas, and, by way of the Southwest Pass, Mississippi River, 437 nautical miles west of New Orleans, Louisiana.

(2) The port's waterfront facilities are along the Sabine River; the Old Channel around Orange Harbor Island; and on the south side of the Orange Municipal Slip. The principal waterborne commodities handled at the port are shell, crude petroleum, and chemicals. There are 35 piers, wharves, and docks; nine are located in shallow-draft channels, two are on the south side of the Orange Municipal Slip, and 24 are along the Sabine River and the Old Channel around Orange Harbor Island. The channel to the port of Orange has an authorized depth of 30 feet and a width of 150 to 200 feet.

(3) Storage facilities include approximately 238,000 square feet of transit shed and about 447,000 barrels of storage for crude oil and refined petroleum products. The Orange County Navigation and Port District has for public use about 3 acres of open storage area served by rail tracks and improved roadway in rear of the transit sheds at the Port of Orange Lower and Upper Wharves. Railroad facilities include service by the Missouri-Pacific Lines and the Southern Pacific Company. The Orange area is served by Interstate Highway 10, U. S. Highway 90, and other state highways.

1. Port of Beaumont

(1) The port of Beaumont, Texas, is on the Neches River, a part of the Sabine-Neches Waterway, at the upper limits of the Neches River Channel, 108 nautical miles east of Galveston, Texas, and, by way of the Southwest Pass, Mississippi River, 456 nautical miles west of New Orleans, Louisiana. The port of Beaumont is 43 miles from the mouth of Sabine Pass, and from this pass it is another 81 miles to the 120 foot bathymetric contour in the Gulf of Mexico. Several bends of the Neches River have been eliminated by cutoff channels between the mouth of the river and Beaumont. This port has an authorized channel depth varying from 30 to 40 feet and in width varying from 200 to 400 feet.

(2) The port's waterfront facilities are along the right bank of the Neches River for a distance of about 19 miles; on the north side of the Beaumont Turning Basin; and on Brakes Bayou.

The principal waterborne commodities handled at the port are crude petroleum,petroleum products, chemicals, liquid sulphur, and wheat.

(3) There are 61 piers, wharves, and docks in the area of the port of Beaumont, Texas. Forty of these facilities are along a 19-mile section of the Neches River, extending from above its mouth at Sabine Lake to below the Interstate Highway 10 bridge upstream; ten, on slips, basins and a canal extending from the right side of the river; three, on the Old River opposite Smith Island; two, on Old Channel opposite Harbor Island; three, on the northerly side of the Beaumont Turning Basin; and three, on Brakes Bayou.

(4) Storage facilities include elevators for about 3,500,000 bushels of grain, about 372,100 square feet of dry storage space, and about a 39,500,000 barrel capacity of storage tanks for crude oil and refined petroleum products.

(5) The port area of Beaumont is served by the Atchison, Topeka and Santa Fe Railway; Kansas City Southern Railway; Missouri-Pacific Railroad; and Southern Pacific Company. Interstate Highway 10 and several U. S. and state highways connect Beaumont with other points in Texas and the United States.

m. Port of Galveston

(1) The port of Galveston, Texas, is in the southeastern part of the State, 437 nautical miles west of New Orleans, Louisiana, via the Southwest Pass of the Mississippi River, and 283 nautical miles northeast of Brownsville, Texas. The port's

principal waterfront facilities are along the northerly side of the eastern portion of Galveston Island and on the south side of Pelican Island; these two islands are separated by the Galveston Channel, which serves the facilities.

(2) Galveston Island is about 30 miles in length, 1 to 3 miles in width, and about 1.75 miles offshore. It is separated from the mainland by Galveston Bay and West Bay. Two bridges and a causeway connect Galveston Island with the mainland to the northwest, a causeway connects Galveston Island with Pelican Island, and a causeway connects the island with the mainland to the south.

(3) From the Gulf of Mexico, deep-draft vessels enter Galveston Bay between Bolivar Peninsula to the northeast and Galveston Island to the south. This entrance is called Galveston Harbor and should not be confused with the port of Galveston. This port is about 15 miles by deepwater channel from the Gulf of Mexico and about 45 miles from 120-foot depth. Galveston Harbor extends from deep water in the Gulf of Mexico through the pass formed by the jetties extending from Galveston Island and Bolivar Peninsula to Bolivar Roads, the deepwater area between Bolivar Point on the north and Pelican Island and Fort Point on the south.

(4) Galveston Bay is an irregularly shaped, shallow body of water, approximately 30 miles long in a general, north-northeast and south-southwest direction, about 17 miles in width at its widest part, and generally about 7 to 9 feet deep.

The Entrance and Outer Bar Channels are 42 feet deep and 800 feet wide. The Inner Bar and Bolivar Roads Channels are 40 feet deep and 800 feet wide. The Galveston Channel has an authorized depth of 40 feet and width of 1,200 feet.

(5) There are 49 piers, wharves, and docks in the vicinity of the port of Galveston, Thirty-two of these facilities are along the east and southerly side of the Galveston Channel, extending from Fort Point near the east end of Galveston Island to a point east of the Pelican Island Cuaseway, a distance of about 4 miles; ten are along the Pelican Island side of the channel; four are on the southerly side of Galveston Bay, west of the foot of 67th Street; and three are on the north side of Offatts Bayou.

(6) Storage facilities include elevators for approximately 7,800,000 bushels of grain, about 7,861,000 square feet of dry storage, about 138,000 cubic feet of cooler and freezer sapce, storage tanks for about 75,000 long tons of liquid sulphur, and storage facilities for an unlimited supply of dry sulfur. Three floating drydocks, six marine railways, and a vertical boat lift are at the five waterfront marine repair plants. One of the floating drydocks has a lift capacity of 15,000 tons and two, 100,000 tons; haulout capacities of the marine railways range up to 250 tons; and the lift capacity of the vertical boat lift is 1,000 tons.

(7) All of publicly owned waterfront terminals at the port of Galveston are served by a terminal railroad known as Galveston Wharves. This railroad, owned and operated by the Board of

Trustees of the Galveston Wharves, has about 43.3 miles of track and connects with and performs switching services for the following railroads serving Galveston and the port area: Atchison, Topeka and Santa Fe Railway; Chicago, Rock Island and Pacific Railroad; Fort Worth and Denver Railway (Burlington Lines); Galveston, Houston and Henderson Railroad; Missouri-Kansas-Texas Railroad; Missouri-Pacific Railroad; and the Southern Pacific Company. Interstate 45 and State Highway 87 connect Galveston with the Texas mainland and the United States.

n. Port of Houston

(1) The port of Houston is in the southeastern part of Texas on the Houston Ship Channel about 50 miles inland from the Gulf of Mexico. The entrance to the port is through a tidal channel extending from the Gulf through jetties between Galveston Island and Bolivar Peninsula across Galveston Bay, a distrance of about 25 miles, then up a part of the San Jacinto River and the Buffalo Bayou to the turing basin at Houston. The deep water of the Gulf of Mexico is about 60 miles from Houston and the 120-foot water depth is about 100 miles. The entrance to Galveston Bay is 328 nautical miles west of the Southwest Pass, Mississippi River, and 278 miles northeast of Brownsville, Texas.

(2) The Houston Ship Channel affords access for ocean-going vessels from the Gulf of Mexico to Houston. It also provides access to barge traffic from the Gulf Intracoastal Waterway which intersects with the Houston Ship Channel and the Texas

City Channel between Bolivar Peninsula, the Texas City Dike, and Pelican Island, an island immediately north of Galveston Island. The Houston Ship Channel is divided into two parts, a deepwater improvement extending from Bolivar Roads to and including the turning basin near Houston, and a shallow-draft channel extending from the turning basin to Main Street in Houston, a distance of about 5-1/2 miles.

(3) All of the port of Houston lies within Harris County. The waterfront area includes Morgan Point, Baytown, Lynchburg, Shell, Norsworthy, Deer Park, Pasadena, Galena Park, Sinco and Clinton below the city limits of Houston and the subdivisions of Manchester, Harrisburg and Magnolia Park with the city. The commerical terminals are on and just below the turning basin, and many industrial plants extend along each side of the channel for several miles below the basin. Houston is one of the main distributing points for the southwestern part of the United States. Some of the principal commodities handled at the port are petroleum and petroleum products, sand and shell, fertilizer and fertilizer materials, steel mill products, grain, sulfur, clay and earths, and chemicals. There are 218 piers, wharves and docks in the vicinity of the port of Houston.

(4) Storage facilities include five elevators for approximately 27,078,150 bushels of grain, about 21 warehouses with about 6,155,000 square feet of dry storage, about 4,464,000 cubic feet of cooler and freezer space, and about 11,928,000 barrels of

storage tanks for crude oil and refined petroleum products. Two floating drydocks and four marine railways are located at five of the waterfront marine repair plants. Todd Shipyards Corp., Houston Division, operates one of the floating drydocks which has a lift capacity of 9,000 tons. Southwestern Barge & Fleet Service, Inc., operates the other drydock which has a lift capacity of 500 tons; haulout capacities of the marine railways range from 500 to 2,000 tons.

(5) Eight plants operate waterfront facilities at the port for the construction, repair, and conversion of ocean-going vessels, steel barges, offshore oil drilling platforms, and tugs, towboats, workboats and other types of small vessels. Gas-freeing and steamcleaning services for tank barges are also available at five of the plants.

(6) General cargo at the port is usually handled to and from vessels by ships' tackle. However, shore-based, hoisting facilities with lifting capacities ranging up to 200 tons and floating cranes and derricks with lifting capacities ranging up to 800 tons are available to the public for performing heavy-lift work at shipside.

(7) The port area of Houston is served by the Atchison, Topeka and Santa Fe Railway; Chicago, Rock Island and Pacific Railroad; Fort Worth and Denver Railway; Galveston, Houston, and Henderson Railroad, Missouri-Kansas-Texas Railroad; Missouri-Pacific Railroad; and the Southern Pacific Transportation Co. In

addition, two terminal switching lines, the Port Terminal Railroad and the Houston Belt & Terminal Railway, also serve the port area. Two interstate highways and several U. S. and state highway connect Houston with other points in Texas and other points in the United States.

o. Port of Texas City

(1) The port of Texas City, Texas, is on the west side of Galveston Bay, about 9 nautical miles northwestward from Galveston and, by way of the Southwest Pass, Mississippi River, it is 442 nautical miles west of New Orleans, Louisiana. This port is about 20 miles via deep water from the Gulf of Mexico and is about 55 miles from the 120-foot water depth.

(2) From the Gulf, deep-draft vessels reach Texas City through the channel between the Galveston entrance channel jetties, the common connection with the Gulf of Mexico for Galveston, Texas City, and Houston; pass the entrance to Galveston Channel; and enter the Texas City Channel from Bolivar Roads.

(3) The authorized Texas City Channel extends through the lower end of Galveston Bay and terminates at the west end of the Industrial Canal. This channel is protected on the north by the Texas City Dike which is about 900 feet north of the channel at its eastern end and about 2,300 feet north at its western end. The Industrial Canal extends in a curving, westerly direction from the southeast end of the main turning basin.

(4) The dimensions of the authorized channel are

40 feet deep, 400 feet wide, and about 6-3/4 miles long. The dimensions of the turning basin at Texas City are 40 feet deep, 1,200 feet wide, and 4,253 feet long. Industrial Canal dimensions have been approved to a depth of 40 feet and widths of between 300 feet and 400 feet with a turning basin at the head of the canal of 40 feet deep, 1,150 feet long, and 1,000 feet wide.

(5) There are 39 waterfront facilities in the port of Texas City; all are either marginal or offshore wharf-type structures. Two of these facilities are on the west side of Galveston Bay south of the inner end of the Texas City Dike; 20 are in the main harbor area, which includes the North, Main, and South Slips opposite Snake Island; and 17 are along the sides of the sides of the Industrial Canal and Turning Basin. The harbor area includes about 11,175,000 barrels of storage for crude oil and refined petroleum products. The Texas City Terminal Railway Co. owns five warehouses located about one-half mile from the channel. These warehouses have a total of 108,200 square feet of storage space, one-half of which is under long-term lease for private storage. The Texas City Terminal Railway has marginal tracks in the vicinity of the harbor area and connects with the Atchison, Topeka and Santa Fe Railway; Rock Island and Pacific Railroad; Fort Worth and Denver Railway (Burlington Lines); Galveston, Houston and Henderson Railroad; and the Southern Pacific Company. State Highway 197 connects the Texas City area with other state and Federal highways.

p. Port of Freeport

(1) Often called Brazos Harbor or Freeport Harbor, the port of Freeport is located along the central portion of the Texas Gulf Coast, about 47 miles southwest of Galveston Harbor Channel entrance and about 145 miles northeast of Corpus Christi Bay. The city of Freeport, with a 1970 population of 12,000, completely surrounds the harbor area. The port of Freeport is a major port for shipping chemicals and petroleum products. This port is about 6 miles via deep water from the Gulf of Mexico and is about 23 miles from the 120-foot water depth. Freeport Harbor area has an authorized depth of 45 feet and width of between 200 and 400 feet. The harbor area includes a channel to the Upper Basin, Brazos Harbor Channel, the channel to Stauffer Chemical Plant, and the channel to Brazosport Turning Basin.

(2) Storage facilities include about 216,000 square feet of transit shed, private storage facilities for about 700,000 barrels of crude oil, and for about 1,350,000 barrels of petroleum products. Railroad facilities include about 3,000 feet of marginal trackage connecting to the Missouri-Pacific Railway. Federal and state highways connect Freeport with other parts of Texas and the United States.

q. Port of Port O'Connor

(1) The deepwater channel, Matagorda Ship Channel, is located about 120 miles southwest of Galveston, Texas. Port O' Connor, a community with a population of 500, is about 474 miles west

of New Orleans via the Gulf Intracoastal Waterway.

(2) Matagorda Ship Channel has a depth of 36 feet and a width of between 200 and 300 feet from the jetties in the Gulf of Mexico through Matagorda Peninsula and across the southwestern portion of Matagorda Bay to and including a 36-foot deep by 1,000-foot square turning basin at Point Comfort, a distance of about 22 miles. A private channel and basins, owned by Aluminum Company of America, are located immediately above the Point Comfort facility.

(3) Matagorda Bay is about 12 miles wide and 16 miles long with natural depths of 9 to 12 feet. A narrow arm of water, about 4 miles wide, extends about 35 miles northeastward from the main body of the bay.

(4) Construction of the Matagorda Ship Channel included the enlargement of the shallow-draft channels and turning basins at Port Lavaca and the Port Lavaca Harbor of Refuge from a depth of 9 to 12 feet and from a width of 100 to 125 feet.

(5) Point Comfort is about 25 miles from deep water and about 53 miles from 120-foot water depth. The waterfront facilities in the area, excluding shallow-draft channels and turning basins, consist of a public turning basin with approximately 3,000 lineal feet of usable berthing space and about 31,125 square feet of transit shed. There are no storage facilities for grain or crude petroleum. Railroad facilities include trackage connecting to the Missouri-Pacific Railroad. State Highway 35 is the primary highway connecting Port Lavaca and Point Comfort with other

parts of Texas.

r. Port of Corpus Christi

(1) The Port of Corpus Christi, Texas, is on the west side of Corpus Christi Bay, 209 nautical miles southwest of Galveston, and 156 nautical miles north of Brownsville. Corpus Christi Bay is an elliptically shaped body of water, about 14 miles long in a northwest-southeast direction, and about 12 miles wide at its widest part, with general depths of from 11 to 13 feet below mean low water. Waters tributary to the Bay are Nueces Bay on the northwest, Red Fish Bay on the northeast, and Oso Bay and Laguna Madre on the south. Corpus Christi Bay is sheltered from the open waters of the Gulf by a low, narrow strip of land known as Mustang Island.

(2) Port facilities at Corpus Christi are along a 9-mile stretch of dredged channels and basins, about 21 miles from the Aransas Pass entrance at the Gulf of Mexico, about 30 miles from deep water and about 50 miles from 120-foot water depth. Corpus Christi Harbor includes five turning basins which are connected by the Industrial Canal, Tule Lake Channel, and the Viola Channel; the turning basins are Corpus Christi, Avery Point, Chemical, Tule Lake and Viola, the terminus of the Corpus Christi Ship Channel (Port Aransas-Corpus Christi Waterway). Other Bay points included in the port of Corpus Christi are: Port Aransas on the north end of Mustang Island, near the inner end of the Aransas Pass, Harbor Island opposite Mustang Island; and Port Inglesdie and La Quinta along the route of the deep-water channels on the north side of Corpus Christi Bay.

Port Aransas has a 12-foot channel.

(3) Arnasas Pass entrance, which connects Corpus Christi Bay and Aransas Bay with the Gulf of Mexico, lies between the southern end of St. Joseph Island and the northern end of Mustang Island. Harbor Island is directly opposite the inner end of the pass, separating Aransas Bay from Corpus Christi Bay.

(4) The Corpus Christi Ship Channel extends from Aransas Pass in the Gulf across Corpus Christi Bay to Corpus Christi. About midway the length of the Channel, the La Quinta Channel leads northward to serve the waterfront at La Quinta; Encinal Channel leads southward to the U. S. Government-owned facilities on Encinal Peninsula. At Ingleside Cover, the Jewel Fulton Canal extends northeastward from La Quinta Channel to a turning basin, a total distance of 1.0 mile.

(5) The Gulf Intracoastal Waterway, which extends from Apalachee Bay, Florida, to Brownsville, Texas, passes between St. Joseph and Harbor Islands and joins the Corpus Christi Ship Channel at mile 2.0 near Port Aransas. This waterway which follows and leaves the Channel at mile 12.5, the junction with Encinal Channel, continues southwesterly through this Channel, and southward through Corpus Christi Bay and Laguna Madre to Brownsville.

(6) The existing project covering the Corpus Christi Ship Channel, a consolidation of the old improvements of Port Aransas and the channel from Aransas Pass to Corpus Christi, has been carried on under successive projects or modifications. The depths

are 47 feet at the Outer Bar Channel and at the outer end of the jetty channel and 45 feet in other deep-draft channels. Widths of the adjacent channels vary from 300 to 400 feet. Width of the channel varies from 600 to 730 feet between the Port Aransas area and Outer Bar Channel and from 400 to 500 feet between Port Aransas and Corpus Christi. Five turning areas are 1,200 feet in diameter, one area is 975 feet and another is 800 feet in diameter.

(7) There are 73 piers, wharves, and docks in the area of the port of Corpus Christi. Twenty-one of these are located in the outer harbor area such as Harbor, Mustang and Dagger Islands, Ingleside area and La Quinta. The remaining 52 are located in the Inner Harbor area. Storage facilities include two waterfront elevators for about 12,000,000 bushels of grain, about 2,167,400 square feet of dry storage space, about 979,000 cubic feet of cooler and freezer space, about 408,000 square feet of transit sheds and about a 25,430,000-barrel capacity of storage tanks for crude oil and refined petroleum products.

(8) All of the publicly-owned, as well as some of the privately-owned, waterfront terminals at the port of Corpus Christi are served by terminal trackage owned by Nueces County Navigation District No. 1. This trackage is operated in turn by the Missouri-Pacific Railroad Company, the Southern Pacific Company, and the Texas Mexican Railway Company, under an agreement which provides for the rotation of the operation among the participating railroads. Several U. S. and state highways connect Corpus Christi with other parts of Texas and the United States.

s. Port of Brownsville

Port Brownsville is the southernmost port in Texas and the southern terminus of the intracoastal waterway system. The main harbor consists of about 3 miles of improved water - frontage, cargo docks, covered and open storage, and grain storage. Railroad service is provided by three companies and the harbor is also served by the Gulf Intracoastal Waterway and state and Federal highways.